Day 1 — Day 3650

the tenth year

annual report 1997–1998

Western Sustainable Agriculture Research and Education

"When tillage begins, other arts follow. The farmers therefore are the founders of human civilization."
–Daniel Webster

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March 27, 1998

TO: SARE STAFF

FROM: KRISTEN

RE: BOUND VERSION OF
WESTERN SARE 1997-98 ANNUAL REPORT

Enclosed is a bound version of Western SARE's new 1997-98 Annual Report.

This version works well as a desk reference. If you need a few more, I have about 20 bound copies, and the Utah State office has about 25.

A packet version (loose sheets in the folder) is also being sent to your office in a bulk mailing leaving this office in a few weeks.

If you need more copies of either type, just let me know.

Kristen Kelleher,
Communications Specialist
SARE, University of California
One Shields Avenue
Davis, California 95616-8716

(530) 752-5987
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Host Institution:
Utah State University
(435) 797-2257

1997-98 Program Report

Western Region
Sustainable Agriculture Research and Education

Introduction

The 1997-98 report marks the tenth year of sustainable agriculture research and education grants and activities in the western region. In dollars and cents, this translates into roughly $18.3 million of scientific exploration, educational outreach and in-the-field inquiry on sustainable agriculture (through federal fiscal year 1997).

Over its decade-long tenure, SARE started from scratch to build a unique participatory and interdisciplinary sustainable agriculture research program. The program expanded to include companion efforts to explore techniques to mitigate agricultural pollution, educate agricultural professionals about sustainable agriculture, and fund producer-led undertakings so farmers and ranchers could test their "real world" questions about field practices.

Growth of the program ensued to meet the needs of its clientele and supporters — an active group of practitioners, scientists, advocates and administrators who deeply care about sustaining agriculture for future generations.

Hand-in-hand with its supporters, the success of SARE is built on its structure and attributes. It brings a broad group of professionals and experts to the table with farmers and ranchers to set priorities, review grants and oversee activities. It balances geographic and cultural diversity on its working committees to provide local perspectives. And, it is dedicated to making farming and ranching profitable and preserving its quality of life by including bottom-line questions in scientific inquiries.

I would like to take this opportunity to thank all of the people who have served on Western SARE's leadership Administrative Council this past ten years, as well as the many others who volunteered on technical review panels, cooperated on funded projects and demonstrated support for SARE in countless ways.

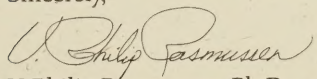
As we begin the second decade of work, the new millennium also quickly approaches. As a federal discretionary program, SARE must always be ready to show the U.S. Congress and the public how it works, why it's valuable and how it has changed agriculture for the better in the nation. We have met this challenge through many political cycles and have gained broad support. With a balanced federal budget in the year 2,000, our best efforts to demonstrate the program's performance to the public and its leaders are of paramount importance.

In everyday terms, however, our prime objectives will continue to include funding high quality research, education and professional development projects; getting sustainable agriculture techniques and practices out to the end-users, farmers and ranchers; and supporting opportunities for information-sharing and productive interaction.

To this end, we have made short, two-page progress reports on active (and former) projects available as we receive them from Project Investigators. We also have many other printed and electronic materials on sustainable agriculture. For these materials, to apply for a grant or to volunteer for a Western SARE activity, please feel free to contact us.

Thank you for your interest in sustainable agriculture and Western SARE. Specific highlights of each grant program, and some regional activities follow.

Sincerely,



V. Philip Rasmussen, Ph.D., regional coordinator

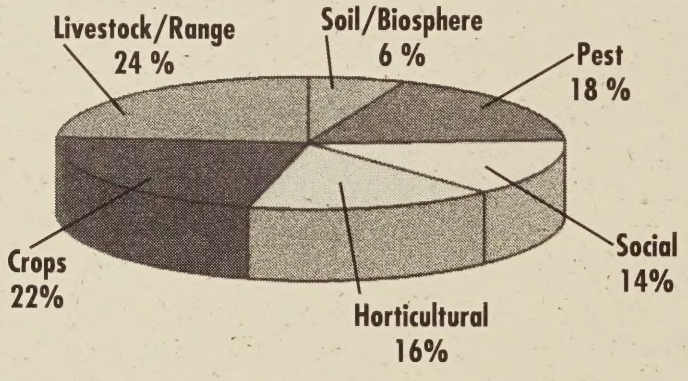
Competitive Grant Programs in 1997

Western SARE administers three competitive grants efforts that are targeted to researchers, educators, agricultural professionals and area producers. They are called: the Sustainable Agriculture Research and Education, SARE effort (which includes some Agriculture in Concert with the Environment, ACE, projects aimed at mitigating agricultural pollution*); the Professional Development Program; and the Farmer/Rancher Research Grant effort.

The tenth round of grant awards provides about $1.9 million in support for research, education and professional development projects in 14 western states and Pacific Island Territories.

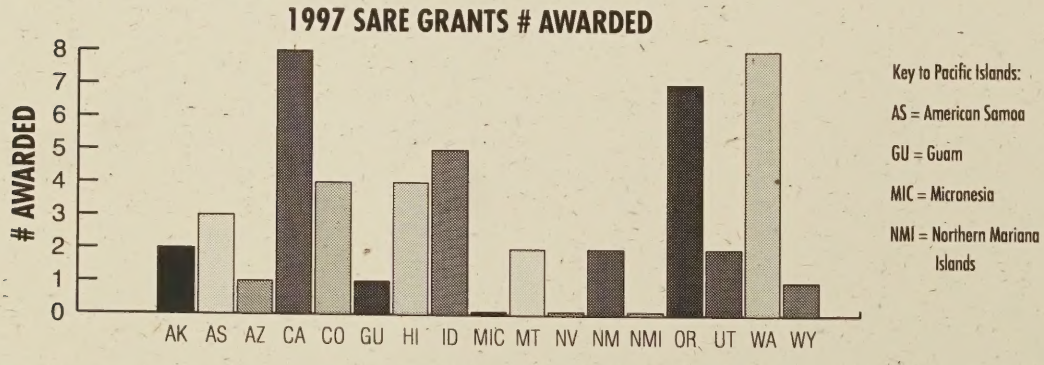
The majority of selected grant work focuses on either livestock or range topics, or a variety of high-value integrated cropping systems. The rest expand knowledge of soil quality and conservation, sustainable agriculture youth education and consumer marketing, alternative crops, pest control, agroforestry, wetlands use, tropical agriculture or new cropping techniques for Navajos.

1997 Type of SARE Grants



The following pie chart illustrates the diversity of general subjects to be studied or discussed with agricultural professionals due to Western SARE support (based on all types of grant awards selected in 1997).

Also, please see the chart below of the number of grants awarded in each state or territory of the USDA Western Region.



Some specifics on each type of grant effort follow.

- SARE Research Grants

The original SARE grant effort comprises the bulk of the region's research and education funding.

*The U.S. EPA provides some funds for ACE grants.

In 1997, 81 SARE proposals were submitted for possible funding, of which 15 were selected by a technical review panel and the Administrative Council. This adds up to about $1.3 million in research support.

The overarching goal of these grants is to increase knowledge of agricultural practices that are economically viable, environmentally sound and socially acceptable. Significant involvement of farmers or ranchers in the planning and implementation of projects is required. In 1997, Western SARE targeted support to work that explored whole farm/ranch systems, or research that addressed weak links or information gaps in agricultural systems.

- Professional Development Program, PDP

This program was initiated to expand understanding of sustainable agriculture concepts and practices by agricultural professionals, including Extension and Natural Resources Conservation Service personnel. Competitive and state-level grants generate educational events and materials for this audience. Networking and information-sharing activities are also conducted by the PDP coordinators.

In 1997, seven competitive grants were funded totaling nearly $425,000. In addition, $161,500 was split among state Cooperative Extension programs in the west to further state-level activities for sustainable agriculture professional development. A regional meeting of research and extension representatives met in Spokane, Washington, in July to discuss such topics as soil quality, quality of life, program evaluation and green marketing. Meeting participants also journeyed to the field to visit local farms that are involved in SARE projects.

According to reports from state Extension leaders for sustainable agriculture, their estimates suggest that most agents have been exposed to the topic and a significant number have advanced knowledge in sustainable agriculture.

- Farmer/Rancher Research Grants

With the awarding of 28 farmer/rancher research grants in 1997, Western SARE has supported nearly 100 producer-led sustainable agriculture projects since the program's beginning in 1995. Just over $100,000 was split among 28 farmer- and rancher-initiated projects this year.

Producers residing in the western U.S. are eligible to apply for a grant of up to $5,000 each to study sustainable agriculture research questions or collective issues through this effort. The regional Administrative Council raised the ceiling on grant amounts for the 1998 cycle (which began with a call for proposals in November 1997) by allowing groups of three or more operators working cooperatively (but running independent enterprises) to apply for grants of up to $10,000 each. The Council also allocated a total sum of $120,000 for 1998 grant awards.

Program Activities

- "Survey of our Stakeholders"

A major project in 1997 was the fielding of an opinion survey targeted to the region's clientele, including researchers and educators, producers, university administrators, non-profit representatives, Cooperative Extension agents and advisors, among others. Primary goals of the survey were to identify the sustainable agriculture research and education priorities, learning preferences and information needs of these key populations. The confidential mail survey was conducted by an outside, university-based research service group. The first public presentation of some survey results will be at the national program's "Ten Years of SARE" conference in Austin, Texas in March 1998.

- Celebrations of SARE's Tenth Anniversary

To commemorate a decade of SARE work across the country, and in the west in particular, the regional program is contributing to a national publication of case studies highlighting funded projects. Western SARE is also unveiling a celebratory poster called "People and Science Are Creating a Sustainable Agriculture," which marks the contributions of farm and ranch families to the scientific and educational goals of Western SARE.

About Western SARE

Western SARE is directed by an Administrative Council of scientists, farmers and ranchers, business leaders and administrators, in cooperation with the USDA SARE office and Cooperative State Research, Education and Extension Service.

Administrative Council members and officers in 1997:

- Jerry Schickedanz, chair (term: August 1997 to August 1999), New Mexico State University, Las Cruces, New Mexico
- Jim Dyer, past chair (term: August 1995 to August 1997), Western Sustainable Agriculture Working Group, Carbondale, Colorado
- Robert Heil, Colorado State University, Ft. Collins, Colorado
- Ralph Nave, USDA Agricultural Research Service, Albany, California
- Kathleen A. McCarthy, U.S. Geological Survey, Portland, Oregon
- Mike Somerville, state conservationist, USDA Natural Resources Conservation Service, Phoenix, Arizona
- Larry Thompson, farmer, Thompson Farms, Boring, Oregon
- Wilbur Wuertz, farmer, Coolidge, Arizona (until August 1997)
- Ray Bernal, Native American producer/consultant, Tucson, Arizona
- Kai Siedenburg, California Sustainable Agriculture Working Group, Santa Cruz, California
- Dennis Teranishi, agronomic consultant, C.E.O., Hawaiian Host, Inc., Pacific Islands, Honolulu, Hawaii
- Rob Myers, SARE director (until June 1997)
- Jerry DeWitt, Iowa State University, Interim SARE director (June 1997 - January 1998) & Extension Service representative
- Jill Shore Auburn, SARE director (beginning January 1998)
- Harry W. Wells, ACE grants director, U.S. EPA

An interdisciplinary group of research and extension scientists, the Western Coordinating Committee (WCC-67) for Sustainable Agriculture, acts as an advisory committee to Western SARE. WCC-67 meets annually to review research and extension progress on sustainable agriculture in the west, discuss professional development issues and make recommendations to the Administrative Council about future directions of Western SARE. The advisory committee also acts as a "core" technical review panel for the regional program's competitive grants process. Complete technical review panels are appointed annually to correspond with the content of proposals to be reviewed in each grant effort. The panel includes farmers, ranchers, scientists, administrators and representatives of non-profit organizations and agri-businesses.

Since 1988 through federal fiscal year 1997, the U.S. Congress has allocated more than $80.7 million to the federal SARE effort; Western SARE has received $18.3 million in funds.

The SARE program, which was authorized by Congress in the 1990 and 1996 Farm Bills, is managed regionally by four councils: Western, North Central, Northeast and Southern United States. These committees of scientists, producers and administrators represent a variety of interests and provide local leadership to research and training efforts. Regional councils operate in cooperation with the USDA SARE office and the Cooperative State Research, Education and Extension Service.

V. Philip Rasmussen, a soil scientist at the program's host institution of Utah State University, is the regional coordinator of Western SARE. The professional development effort was co-coordinated by Jill Shore Auburn, University of California, until the end of 1997. (She now directs the National SARE program at the USDA headquarters office.) Al Kurki of the National Center for Appropriate Technology, NCAT, Montana, continues to coordinate the PDP program in 1998.

The region includes Alaska, American Samoa, Arizona, California, Colorado, Guam, Hawaii, Idaho, Micronesia, Montana, Nevada, New Mexico, N. Mariana Islands, Oregon, Utah, Washington and Wyoming.

Writer: Kristen Kelleher. Editor: Eileen O'Farrell. Editorial Review: V. Philip Rasmussen, Ph.D., Rhonda Miller, Ph.D., and Al Kurki. Graphic design: Marianne Post and Todd Zerger, UC Davis Repro Graphics.

How to Apply for a Grant

Western Region
Sustainable Agriculture Research and Education

Timelines for Grant Programs

Western SARE administers three grants efforts: the original Sustainable Agriculture Research and Education, SARE, program, which strives to expand scientific knowledge of sustainable farming and ranching practices; the Professional Development Program, which aims to educate agricultural professionals about sustainable agriculture; and, the Farmer/Rancher Research Grant effort, which supports producer-directed research and community development activities.

All grant programs operate on an annual (once-a-year) cycle and have a competitive selection process. General deadlines for calls for proposals and corresponding due dates:

- SARE: call for proposals released in mid-summer; proposals due by mid-October.
- Professional Development Program: call for proposals released in tandem with SARE in mid-summer; proposals due in mid-November.
- Farmer/Rancher Research Grants: call for proposals released in November; deadline for submission in mid-January.

How to Receive a Call for Proposals & Where to Apply

Calls for proposals are automatically mailed to those on the distribution list at the time the call is released, or sent out individually during the application period. To add your name to the early distribution list, or to get an application after the release date, contact the Western SARE office via mail, e-mail, telephone or fax at:

Western SARE
Utah State University
Agricultural Science Bldg, Room 322
4865 University Blvd.
Logan, UT 84322-4865
(435) 797-2257
(435) 797-3376
wsare@mendel.usu.edu

It is particularly important to specify the grant program(s) in which you are interested.

Calls for proposals — as well as research and program accomplishments and more — are also available on-line via Western SARE's Web site at **http://ext.usu.edu/wsare/**

Sustainable Agriculture Resources

Western Region
Sustainable Agriculture Research and Education

The SARE program puts high emphasis on getting research results and practical information on sustainable agriculture to those who need it in a timely and useful fashion. Following are resources for information on sustainable agriculture. Western SARE activities, accomplishments and materials are also available on-line at **http://ext.usu.edu/wsare/**

If follow-up information is not given, contact the Western SARE public information office at (530) 752-5987 or kkelleher@ucdavis.edu.

SARE PUBLICATIONS & ON-LINE MATERIALS

To request any of these FREE publications, contact the Western SARE public information office.

- *Western Region SARE Annual Reports,* 1996 and 1995 editions
- *Eight Years of Progress: 1988-1995.* An overview of eight years of accomplishments in the Western SARE program.
- *The Western SARE Professional Development Program* brochure. A primer on training and educational programs aimed at agricultural professionals, and a contact list of designated state leaders for sustainable agriculture.
- *National SARE Project Highlights* (1993-97 editions), including brief and colorful highlights of research across the nation.
- *Exploring Sustainability in Agriculture* brochure (limited quantities)
- Western SARE has calls for proposals, news releases, project accomplishments and other resources available on-line at **http://ext.usu.edu/wsare/**

SAN: PUBLICATIONS, NATIONAL DATABASES, ON-LINE MATERIALS

The Sustainable Agriculture Network is the outreach arm of the national SARE program. A number of resource publications, handbooks and electronic materials, and networking opportunities are available. A national database of SARE project outcomes and other information is also available on-line via the SAN/SARE Web site at: **http://www.sare.org/.**

Publications include:

- *Steel in the Field: A farmer's guide to weed management tools.* A farmer-oriented handbook with 45 drawings accenting technical descriptions on tools' roles, designs and costs. Index, contact list, tool source list. $18
- *The Source Book of Sustainable Agriculture.* A national guide of handbooks, Web sites, newsletters, conference proceedings, bulletins, videos and more that focus on sustainable agriculture topics. Each of the more than 500 entries has a detailed product description and ordering information. Price: $12

- *The Sustainable Agriculture Directory of Expertise* (print or on computer diskette/Folio software). A list of over 700 people and organizations willing to share their expertise in sustainable agriculture. Price: $18.95
- *The Real Dirt.* Farmers tell about organic and low-input practices in the Northeastern U.S. Price: $13.95
- *Profitable Dairy Options: Grazing • Marketing • Nutrient Management.* A brochure on sustainable dairy farming which focuses on rotational grazing, new marketing approaches and some references for feedlot-oriented systems. FREE.

To order, send a check or purchase order (or written request) to Sustainable Agriculture Publications, Hills Building, University of Vermont, Burlington, VT, 05405-0082, or fax to (802) 656-4656. For bulk discounts and rush orders, phone (802) 656-0471 or e-mail msimpson@zoo.uvm.edu. For general information about SAN, contact coordinator Andy Clark at (301) 504-6425, or san@nal.usda.gov.

WESTERN REGIONAL NEWSLETTER

- *Sustainable Agriculture* (a publication of the University of California's Sustainable Agriculture Research and Education Program). This FREE newsletter provides practical information, announcements and technical and research summaries. For a list of other materials or to subscribe, contact UC SAREP at (530) 752-7556.

WESTERN SARE PUBLICATIONS, VIDEOS, GUIDES, HANDBOOKS & MORE: ORGANIZED BY TOPIC

All of the following resource materials were developed with support from Western SARE regional grants, except the noted SAN publications.

Directories: Expertise, Materials

- *The Sustainable Agriculture Directory of Expertise* (print or computer diskette/Folio software). A list of over 700 people and organizations willing to share their expertise in sustainable agriculture. Price: $18.95 See SAN section for ordering information. (SAN)
- *Source Book of Sustainable Agriculture.* A national guide of handbooks, Web sites, newsletters, conference proceedings, bulletins, videos. Each of the more than 500 entries has a detailed product description and ordering information. Price: $12. See SAN section for ordering information. (SAN)

Research Design and Community Participation

- *Farmer/Scientist Focus Sessions: A How-To Guide.* By Daniel Green-McGrath, Larry S. Lev, Helene Murray and Ray D. William. Order up to six free-of-charge. Contact: Publications Orders, Agricultural Communications, Oregon State University, Administrative Services, A422, Corvallis, OR, 97331-2119, or phone (503) 737-2513.
- *Whole Farm Case Studies: A How-To Guide.* By Helene Murray, Daniel Green-McGrath, Larry S. Lev and Alice Mills Morrow of Oregon State University. Order up to six free-of-charge. Contact: Publications Orders, Oregon State University at same address as above.
- *Participatory On-Farm Research and Community Involvement in Agriculture and Environmental Issues: An Annotated Bibliography,* January 1980 - May 1992
- *Facilitator's Guide to Involving the Public in Applied Agricultural Research: Planning and Coalition Building,* August 1992
- *Land Grant University Agriculture and Natural Resources Research: Perceptions and Influence of External Interest Groups*

- *Exploring the Unique Qualities of Sustainable Agriculture Research and Education.* Reference #MISC0178. FREE. Bulletins Office, Cooperative Extension, Cooper Publications Bldg., Washington State University, Pullman, WA, 99164-5912. Phone: (509) 335-2857.
- *Community Ventures: Partnerships in Education and Research.* A series of publications (costing $1.00 each) on participatory methods for working with and learning from diverse audiences. Contact: Bulletins Office (same address and phone number as above), Washington State University.

Producer Research

- *On-Farm Testing: A Grower's Guide.* Contact: Cooperative Extension, College of Agriculture & Home Economics, Washington State University, Pullman, WA, 99164-6420.

Pacific Northwest Agriculture

- *A Resource Guide to Sustainable Agriculture in Washington and Oregon.* A resource guide of more than 200 pages tailored to this region. No charge while supply lasts. Contact: Guide # EM8531, Publications Orders, Oregon State University, at Administrative Services, A422, Corvallis, OR, 97331-2119, or phone (503) 737-2513.
- *Farming For Profit and Stewardship, Sustainable Agriculture in the Pacific Northwest.* Proceedings of the West Cascade Conference for 1989, 1990, 1991.
- *Farming For Profit and Stewardship, Sustainable Agriculture in the Pacific Northwest,* 1989. Proceedings of the Tri-State symposium. Contact: Department of Agronomy and Soil Science, Washington State University, Pullman, WA, 99164-6420.
- *Issues in Sustainable Agriculture: A Study of Horticultural Producers in Western Oregon and Washington*
- *Whole Farm Case Studies of Horticultural Crop Producers in the Maritime Pacific Northwest.* Contact: Publications Orders, Oregon State University, Administrative Services, A422, Corvallis, OR, 97331-2119, or phone (503) 737-2513.

Cover Cropping

- VIDEO: *Creative Cover Cropping in Perennial Farming Systems.* How to use cover crops in orchards and vineyards to improve soil fertility, enhance pest control and provide other benefits. Price: $20. Contact: UC SAREP, University of California, Davis, CA, 95616, or phone (530) 752-7556.
- VIDEO: *Creative Cover Cropping in Annual Farming Systems.* Cover cropping in row and field crop systems. Price: $20. Contact: UC SAREP at same address as above.

Sustainable Farming and Ranching Systems

- VIDEO: *Pleasant Grove Farms: A Case Study.* A case study of a northern California family farm that has transitioned to sustainable practices. Length: 22 minutes. Price: $20. Contact: Reference # V/94-Z, Communication Services, 1441 Research Park Drive, Room 131, University of California, Davis, CA, 95616, or phone (530) 757-8980.
- VIDEO: *UC Sustainable Agriculture Farming Systems Project.* Length: 22 minutes. The video provides an overview of the long-term University of California, Davis-based sustainable farming systems project, including background on experimental design, the participatory research process and current findings. Price: $15. Contact: SAFS Project, Dept. of Agronomy & Range Science, University of California, Davis, CA, 95616. Phone: (530) 752-8940.
- *Sustainable Farming Systems Project Newsbulletin.* Reports emerging results from this long-term project, which is comparing organic, low-input and conventional production systems for key northern California crops, such as processing tomatoes. Contact: SAFS Project (at address and

phone above). The bulletin is also available on the project's Web site at **http://agronomy.ucdavis.edu/safs/home.htm.**

- VIDEO: *Video Introduction to Sustainable Agriculture for the Western States.* A 10-minute film to educate agriculture professionals and the public about the value and basic principles of sustainable agriculture. Contact: Joe Hiller, University of Wyoming Cooperative Extension Service, at (307) 766-5479 or 766-2196.
- VIDEO: Taped presentation of *Sustainable Agriculture Telecast/Teleconference: Training our Trainers.* A videotape of the interactive teleconference that provided an initial overview of sustainable agriculture techniques and issues for professional development of agricultural professionals. Contact: Joe Hiller, University of Wyoming Cooperative Extension Service, at (307) 766-5479 or 766-2196.
- VIDEO: *Sustainable Agriculture Perspectives from Across America: Introduction to Concepts and Principles,* 1996. A 23-minute video suited for professional development training venues. To order, e-mail SARE002@unlvm.unl.edu or call (402) 472-7081 for a FREE copy while supplies last.
- *Learning from the BIOS Approach, A Guide for Community-Based Biological Farming Programs.* The guide gives an overview of on-the-ground operations, and identifies lessons learned while implementing this style of program. The guide is FREE for a limited time. Contact: Carla at the Community Alliance with Family Farmers at (530) 756-8518, ext. 15 or via e-mail at caff@caff.org.

Marketing , Farm/Ranch Management, Economics

- *1992 Alternative Crop Rotation Enterprise Budgets, Whitman County, Washington.* Contact: Department of Agricultural Economics, Department of Crop and Soil Sciences, Cooperative Extension, Washington State University, Pullman, WA, 99164-6420.
- *Western Farm Management Extension Committee, Total Resource Budget Compendium,* August 1992
- *Marketing Sustainable Agriculture: A Promoter's Toolbox.* Methods for encouraging the adoption of sustainable agriculture among growers. Length: 77 pages. Price: $14.00. Contact: Publication #3367, Agricultural Information & Publications, Communication Services, University of California, Davis, California, 95616-8511, or phone (530) 757-8930.

Dryland Farming

- *Long-Term Management Effects on Soil Productivity and Crop Yield in Semi-Arid Regions of Eastern Oregon,* November 1989. Contact: Paul E. Rasmussen, USDA - Agricultural Research Services, Columbia Plateau Conservation Research Center, P.O. Box 370, Pendleton, OR, 97801. Phone: (503) 276-3811.
- *Dryland Farming In The Northwestern United States.* Contact: Washington State University, Cooperative Extension, Pullman, WA, 99164-6420.
- *Amber Waves,* 1992. Contact: Bulletins Office, #XB1025, Cooperative Extension, Washington State University, Pullman, WA, 99164-5912.
- *Cereal-Legume Cropping Systems: Nine Farm Case Studies in the Dryland Northern Plains, Canadian Prairies, and Intermountain Northwest.* Contact: Alternative Energy Resources Organization (AERO), 25 So. Ewing, Suite 214, Helena, MT, 59601. Phone: (406) 443-7272.
- *Sustainable Agriculture in the Northern Rockies and Plains.* Contact: AERO at above address.
- *Prospects For Sustainable Agriculture in the Palouse: Farmer Experience and Viewpoints,* 1990. Contact: Washington State University, Pullman, WA, 99164-6420.
- *Austrian Winter Peas for Dryland Green.* A bulletin. Contact: Jim Krall, University of Wyoming, (307) 532-7194 or jkrall@uwyo.edu.

Soil Fertility

- *Proceedings of AERO's Soil-Building Cropping Systems Conference.* Contact: Alternative Energy Resources Organization (AERO), 25 So. Ewing, Suite 214, Helena, MT, 59601. Phone: (406) 443-7272.

Protecting Natural Resources

- *Washington Agriculture: Sustaining Water, Land and People, Clean Water for Washington.* Contact: Bulletins Office, #EB1634, Cooperative Extension, Washington State University, Pullman, WA, 99164-5912.
- *Protecting Ground Water From Agricultural Chemicals: Alternative Farming Strategies For Northwest Producers.* Contact: AERO, 25 So. Ewing, Suite 214, Helena, MT, 59601. Phone: (406) 443-7272.
- *Cover Crops for Clean Water.* Proceedings of an international conference. Edited by W. L. Hargrove; authored by J. R. Sims and A. E. Slinkard.
- *Cropping Strategies and Water Quality 1993 Annual Report*

Tropical Agriculture

- *Taro Production Systems In Micronesia, Hawaii and American Samoa.* Contact: L. Ferentinos and A. Vargo, American Samoa Community College, Pago, Pago, AS.
- *Sustainable Taro Culture in the Pacific, The Farmers Wisdom.* Contact: Pacific Agricultural Development Office, Tropical Energy House, East-West Road, University of Hawaii, Honolulu, HI, 96822. Fax: (808) 956-6967.
- VIDEO: *Nourish The Roots Gather The Leaves - Sustainable Taro Culture in the Pacific.* American Samoa Community College, Pago, Pago, AS.

Ranching, Livestock/Crop Systems, Dairy

- *Profitable Dairy Options: Grazing • Marketing • Nutrient Management.* A brochure on sustainable dairy farming which focuses on rotational grazing, new marketing approaches and some references for feedlot-oriented systems. FREE. For ordering information, see SAN section above. (SAN)
- *Proceedings of Livestock Health and Nutrition Alternatives: A Western States Conference.* Contact: AERO at 25 So. Ewing, Suite 214, Helena, MT, 59601. Phone: (406) 443-7272.
- *Sustainability of Range Livestock Production Systems in the West,* proceedings of a September, 1994, regional conference. Sponsored by Montana State University, MSU Extension and Western SARE.
- *Crop and Livestock Production Systems for Land in the Conservation Reserve Program,* Progress Reports, New Mexico State University Cooperative Extension and Agricultural Experiment Station. Contact: Rex Kirksey, New Mexico State University, Agricultural Science Center, 6502 Quay Road, AM.5, Tucumcari, NM, 88401.
- *Intermountain Workgroup "How To" Monitor Rangeland Resources, (Level I, Beginning and Level II, Advanced),* University of California Cooperative Extension, December, 1994. Contact: UCCE, County of Tehama, P.O. Box 370, 1754 Walnut Street, Red Bluff, CA, 96080.
- *Nutrient Management for Dairy Production: Dairy Manure as a Fertilizer Source.* Extension Bulletin #EM 8586, Oregon State University Extension Service, Corvallis, OR.
- AUDIO TAPE SERIES: *California Grazing Academy.* The tapes provide follow-up support to Grazing Academy alumni and introduce all ranchers to the principles and practices of controlled grazing. (Related to a SARE project on this topic.) For cost and ordering information, contact David Pratt, University of California Cooperative Extension, Solano County, at (707) 421-6791 or dwpratt@ucdavis.edu.

Insect and Weed Control

- AUDIO TAPE: *Habitat For Diversity and Pest Control.*
- *Steel in the Field: A farmer's guide to weed management tools.* A farmer-oriented handbook with 45 drawings accenting technical descriptions on tools' roles, designs and costs. Index, contact list, tool source list. $18. See SAN section for ordering information.

Agroforestry

- VIDEO: *Fire & Water Restoration of a Pinyon-Juniper Watershed.* Contact: Howard Shanks, RC&D Coordinator, Box 457, Carrizozo, NM, 88301. Phone: (505) 648-4293 or -2941.
- *Restoration of A Pinyon-Juniper Ecosystem* (Companion to above video). Contact above.
- VIDEO: *Fire & Water: Restoring the Promise.* A 15-minute video that provides supplementary information to the first "Fire & Water" video mentioned above. Contact Howard Shanks as detailed above.

Social Science & Sustainable Agriculture

- VIDEO: *Social Capital and Sustainability. The Community and Managing Change in Agriculture.* Price: $20 (plus $5 shipping charge). Contact: North Central Regional Center for Rural Development, Iowa State University, 404 East Hall, Ames, IA, 50011. Phone: (515) 294-8321.

Permaculture

- *Permaculture-Sustainable Farming, Ranching, Living...by Designing Ecosystems that Imitate Nature.* Central Rocky Mt. Permaculture Institute. Contact: Jerome Osentowski, Central Rocky Mt. Permaculture Institute, P.O. Box 631, Basalt, Colorado, 81621, (970) 927-4158. Internet: http://sunsite.unc.edu/london/permaculture.html.

Solorization

- AUDIO TAPE: Perspectives on Solarization.

Electronic and Internet Resources

- Western SARE Web site at http://ext.usu.edu/wsare/. Western SARE has calls for proposals, news releases, general and research information at the site.
- SAN/SARE Web site at: http://www.sare.org/. National clearinghouse for SARE activities and regional efforts, including a searchable database of SARE projects.
- Sanet-mg. An electronic-mail discussion group of about 800 scientists, educators, producers and administrators from across the nation, which is sponsored by SAN. Through interactive questions-and-answers or general discussion, participants can find specific information and learn about sustainable agriculture approaches in diverse settings. To subscribe to sanet-mg, contact Andy Clark at (301) 504-6425 or san@nal.usda.gov.

Western Region SARE Grants Awarded in 1997

State-by-State or Island Protectorate

Western Region
Sustainable Agriculture Research and Education

State	Grant Recipient	Award	Subject
Alaska	Michael T. Panciera, University of Alaska	$100,000.00	No-Till; Soil Conservation
	David C. Smith, producer	$5,000.00	Ginseng Production
	Total Funding for Alaska:	*$105,000.00*	
American Samoa	Wayne A. Frank, American Samoa Community College	$91,850.00	Sustainable Food Production
	Don Vargo, American Samoa Comm. Coll.*	$15,510.00	Medicinal Herbs, Plants*
	Malo Paleso'o, producer	$2,315.00	Agroforestry
	Total Funding for American Samoa:	*$109,675.00*	
Arizona	Edward P. Glenn, University of Arizona	$95,201.00	Aquaculture, Edible Red Seaweed
	Total Funding for Arizona:	*$95,201.00*	
California	John T. Trumble, University of California, Riverside	$100,000.00	Pest Control in Celery
	Jeff Mitchell, University of California, Davis	$41,604.00	Nutrient Dynamics in Cover Crops
	Kent M. Daane, University of California, Berkeley	$79,858.00	Pest-Resistant Crops
	Larry Galper, producer	$5,000.00	Sustainable Strawberry Production
	Jim Wackerman, producer	$3,248.00	Confinement vs. Pasture, Dairy
	Dave Renner, producer	$5,000.00	Composting Demonstration
	Willis Thompson, producer	$5,000.00	Biocontrol with Pheromones
	David Pratt, University of California*	$29,000.00	Sustainable Dairy, Livestock*
	Total Funding for California:	*$268,710.00*	
Colorado	Trent Taylor, producer	$2,500.00	Specialty Crops
	Douglas B. Wiley, producer	$1,825.00	Perrenial Grasses
	Pete Mattics, producer	$2,500.00	Pasture Fryer Chickens
	Steve Carcaterra, Colorado State University*	$4,400.00	Community-Supported Ag*
	Total Funding for Colorado:	*$11,225.00*	
Guam	Felix Quan, producer	$4,300.00	Cucumber Production
	Total Funding for Guam:	*$4,300.00*	
Hawaii	John Mc Hugh, Waikele Farms, Inc.	$21,900.00	Tomatoes and Cucumbers
	Paul D. Acciavatti, producer	$3,500.00	Weed Control Alternatives
	Jon Biloon, producer	$4,000.00	Sustainable Papayas
	John Craven, Common Heritage*	$64,295.00	Pacific Islands Training*
	Total Funding for Hawaii:	*$93,695.00*	

State	Grant Recipient	Award	Subject
Idaho	Patrick A. Momont, University of Idaho	$105,400.00	Beef Cattle, Riparian Grazing
	Jay Black, producer	$5,000.00	Range Systems
	Mark Pratt, producer	$5,000.00	Controlled Grazing
	Robert Rynk, University of Idaho*	$145,275.00	Composting Education*
	Christina Crawford, producer	$3,500.00	Non-Irrigated Alfalfa
	Total Funding for Idaho:	*$264,175.00*	
Montana	Andrew W. Lenssen, Montana State University	$150,964.00	Pest Control in Wheat Systems
	Nancy Matheson, Alternative Energy Res. Org.*	$100,000.00	Youth Education*
	Total Funding for Montana:	*$250,964.00*	
New Mexico	Tom Siebel, producer	$3,500.00	Value-Added Wheat
	Matt Schneberger, producer	$3,500.00	Gopher Control by Grazing
	Total Funding for New Mexico:	*$7,000.00*	
Oregon	Karen Murphy, NW Coalition for Alt. To Pesticides	$35,000.00	Sustainable Potato Production
	Kathleen Panner, producer	$3,500.00	Pasture "Foxtail" Control
	Tim Grant, producer	$2,800.00	Douglas Fir Production
	Ann R. Snyder, producer	$3,500.00	Goats to Control Brush
	Gary Shull, producer	$3,200.00	Wetlands for Waste Water
	George Ing, producer	$5,000.00	Biocontrol for Pear Pests
	David Hannaway, Oregon State University*	$65,000.00	Grazing Management*
	Total Funding for Oregon:	*$118,000.00*	
Utah	Michael E. Noel, producer	$2,900.00	Increased Forage Production
	Mark Maryboy, producer	$4,300.00	Alt Cropping on Navajo Resv.
	Total Funding for Utah:	*$7,200.00*	
Washington	Shiou Kuo, Washington State University	$118,000.00	Cover Crops
	Tim Fiez, Washington State University	$125,842.00	No-Till and Conserv. Farming
	L. Michael Butler, Washington State University	$113,000.00	Ag On the Urban Edge
	Terry Swagerty, producer	$2,043.00	Rotational Grazing
	R.D. Northcraft, producer	$2,000.00	Bamboo, Alternative Crop
	Brain Cieslar	$1,850.00	Spider Mite Control
	David Carlton, producer	$3,000.00	Dryland Corn Production
	Therese Critchley, producer	$2,500.00	Harvest Labor Reduction
	Total Funding for Washington:	*$368,235.00*	

* These projects have a specific goal to provide professional development opportunities for Extension and Natural Resources Conservation Service personnel, and other agricultural professionals.

Farmer / Rancher Research Grants

Western Region
Sustainable Agriculture Research and Education

The farmer/rancher research grant program makes producers and producer groups residing in the Western U.S. eligible to compete for grants to identify, evaluate and test sustainable agriculture practices and challenges. Individuals can apply for up to $5,000; producer groups (three or more farm/ranch operations working cooperatively) can apply for up to $10,000.

Begun in 1995, nearly 100 producer-directed research grants have been funded in the Western region since its inception. The effort gives farmers and ranchers direct access to research and education funds authorized by the U.S. Congress to further the adoption of sustainable agriculture.

Grant proposals are reviewed and evaluated by a diverse group of producers, researchers, educators and administrators who are familiar with sustainable agriculture. Final selections are made by an appointed panel, at least half of which are producers. All funding is awarded competitively.

Grant reviewers look for potential projects that clearly define local sustainable agriculture problems or issues and propose innovative solutions. On-farm tests of suggested technologies and approaches are strongly encouraged. All research proposals must be led by one or more producers, include a professional agricultural technical advisor (an extension agent or university researcher, for example) and provide a plan for sharing gained information with others in the community.

Calls for proposals for Farmer/Rancher Research Grants are usually distributed in November, and are due for submission in January. To find out how to apply for a grant, or to get on the mailing list for a call for proposals, contact the Western SARE office at (435) 797-2257 or wsare@mendel.usu.edu. Past and current calls for proposals and other information is always available on-line via the Western SARE Web site at **http: //ext.usu.edu/wsare/**

FARMER / RANCHER GRANTS

Following is a list of farmer/rancher research efforts, organized by state or territory. The 1997 projects include brief descriptions. Grants funded in 1996 and 1995 are also listed. Summaries of these projects are in Western SARE's 1996 Annual Report.

Alaska

Growing American and Korean Ginseng in Alaska (1997)
Producer: David C. Smith
Location: Anchorage, Alaska
Grant Award: $5,000
Summary: American ginseng seed and root stock and Korean ginseng seed will be planted in various locations in Alaska to evaluate its feasibility as an appropriate and profitable crop. Conditions of soil temperature, photo-period, percent shade, moisture, wild pests and local disease appear to be ideal for ginseng culture, possibly affording a new use for underutilized wooded parcels throughout the state.

Establish more Efficient and Biological Practice for Bringing Forest Land into Agricultural Use through Sustainable Development Using Indigenous Species in Alaska (1996)
Producer: Vickie Talbot
Location: Trapper Creek, Alaska; Grant Award: $3,000

Establish More Efficient and Biological Practices for Bringing Forest Land into Agricultural use Through Sustainable Development using Indigenous Species in Alaska (1995)
Producer: Vickie Talbot
Location: Trapper Creek, Alaska; Grant Award: $5,000

American Samoa

Continuation of a Sustainable Agroforestry System (1997)
Producer: Malo Paleso'o
Location: Tutuila, American Samoa
Grant Award: $2,315
Summary: This project continues to attempt to stabilize steeply sloping land and improve its use by repairing hedgerows, replacing old food crops with more hedges, and comparing plots of traditional Samoan crops with plots of vegetables to see which will be more successful.

Pig Manure Control and Utilization Project (1996)
Producer: Tovia Tuli
Location: Pago Pago, American Samoa; Grant Award: $5,000

Composting Farm and Kitchen Wastes in American Samoa (1995)
Producer: Juan Chan
Location: Pago Pago, American Samoa; Grant Award: $721.41

Development of a Sustainable Agroforestry System (1995)
Producer: Malo Paleso'o
Location: Tutuila, American Samoa; Grant Award: $2,765

Controlling the Banana Scab Moth Caterpillar in American Samoa Through Cultural Methods (1995)
Producer: Fetalai Lefee
Location: Pago Pago, American Samoa; Grant Award: $1,400

Arizona

Moving Succession Forward in a Lehmann Lovegrass Monoculture (1996)
Producer: Steve Getzwiller
Location: Benson, Arizona; Grant Award: $3,000

Goal-Driven, Intensive Management of a Riparian/Sandy Bottom Site (1996)
Producer: Kali Holtschlag
Location: Dragoon, Arizona; Grant Award: $4,310

Managing Biological Processes for Maximum Diversity and Productivity (1996)
Producer: Mike Mercer
Location: Benson, Arizona; Grant Award: $2,500

California

Pheromone Foggers for Pesticide Replacement (1997)
Producer: Willis Thompson
Location: Grenada, California
Grant Award: $5,000
Summary: Using battery-powered foggers to spread natural codling moth pheromones in apple orchards, this project hopes to reduce moth damage to organic orchards sufficiently to make them competitive. Current losses from the moths range from 40 percent to 98 percent in organic orchards, compared to 10 percent in pesticide-treated ones. Use of pheromones, which disrupt mating behavior, may reduce pest counts as much as 95 percent.

Vermicomposting Demonstration Project (1997)
Producer: Dave Renner
Location: Ferndale, California
Grant Award: $5,000
Summary: A dairy hopes to demonstrate to other Eel River dairies the benefits of on-farm, in-vessel composting of cow manure with worms, helping them to meet new water quality regulations in an affordable manner while also creating a profitable new byproduct. A commercial worm farmer will help market the worms and worm castings. Using plastic bins for the composting increases temperature and reduces contamination by soil.

Feasibility of Soil Solarization for Strawberry Production on the Central Coast of California (1997)
Producer: Larry Galper and Ed Kelly
Location: Watsonville, California
Grant Award: $5,000
Summary: Soil solarization is a non-pesticidal method of reducing soil pests prior to planting high value crops. These producers, searching for an alternative to methyl bromide (scheduled to be phased out in 2001 in California but not in competitive areas) for controlling weeds and soil-borne fungal pathogens, will investigate whether soil solarization will work as a means of preparing soil for strawberry production in two of the most important locations along the central coast. The results of this project should enable farmers to make an informed decision about the utility of this technique for this area.

Individual Confinement Rearing versus Pasture-based Group Rearing of Dairy Calves (1997)
Producer: Jim Wackerman
Location: Orland, California
Grant Award: $3,248

Summary: This project's goal is to assess pasture-based group rearing of unweaned dairy calves. Traditional U.S. calf rearing methods are demanding of labor, capital and equipment. New Zealanders have successfully mob-reared calves on pasture for a long time, but the practice has not been widely adopted here. If successful here on irrigated pasture, this style of calf rearing may present new opportunities to improve pasture utilization and animal performance, health and wellbeing while reducing costs, waste management problems and labor.

Farming, Agriculture and Resource Management for Sustainability (F.A.R.M.S.) (1996)
Producer: Craig McNamara
Location: Winters, California; Grant Award: $5,000

Monitoring Program for Biologically Integrated Orchard Systems (BIOS) in Walnuts (1995)
Producer: Liza Lewis
Walnut BIOS Management Team
Location: Davis, California; Grant Award: $5,000

Colorado

Pasture Fryer Chickens (1997)
Producer: Pete Mattics
Location: Olathe, Colorado
Grant Award: $2,500
Summary: Although demand is high, no fresh fryer chickens are presently available for local markets. This project hopes to demonstrate that baby chicks can be grown on two acres of high-protein pasture grasses into high quality, chemical-free market fryers. It will also identify the marketing opportunities for this product locally and throughout western Colorado.

Establishing Perennial Grass in Existing Alfalfa (1997)
Producer: Douglas B. Wiley
Location: Boone, Colorado
Grant Award: $1,825
Summary: This project hopes to show that using management-intensive grazing can help preserve dairying in the face of escalating feed costs and waste management problems. Establishing the necessary mixed pastures is difficult in an arid climate, but by interseeding grasses into existing alfalfa fields, advantage can be taken of the soil structure and high biological activity that has been developed, promoting a strong nutrient cycle and economic forage yields under careful grazing management. Spring drilling and fall broadcasting of grass seed into existing alfalfa will be tested.

Converting Pasture Land to Specialty Crop Production as an Alternative Farm Enterprise (1997)
Producer: Trent J. Taylor
Location: Hesperus, Colorado
Grant Award: $2,500
Summary: To increase family incomes and better utilize pasture land, this project proposes to demonstrate to skeptical farmers and non-farm home-owners the economic viability of producing organic dried herbs and flower seeds on land previously used only for livestock grazing.

Habitat Management as a Transitional Tool to an Insecticide-free Pest Management Program in Apples (1996)
Producer: Bob White
Location: Hotchkiss, Colorado; Grant Award: $1,500

Evaluation of Alternative Crops in Dryland Multi-Crop Rotations on Farms in the Northeastern Colorado Region (1995)
Producer: Joe Kinnie
Location: Julesburg, Colorado; Grant Award: $5,000

Guam

Use of Sunnhemp as a Cover Crop in Cucumber Production (1997)
Producer: Felix Quan
Location: Tamuning, Guam
Grant Award: $4,300
Summary: The project hopes to show that interplanting hedgerows of sunnhemp as a green manure crop will improve sustainability of small, frequently replanted plots of cucumbers by improving soil fertility and decreasing disease, weeds and pests. Sunnhemp may also prove useful as green manure for similar crops.

Dry-Extrusion of Wet Garbage for Swine Feeding (1996)
Producer: George Pangelinan
Location: Yigo, Guam; Grant Award: $4,350

Vegetable Soybean Cultivator Trials (1996)
Producer: Felix Quan
Location: Tamuning, Guam; Grant Award: $3,020

Hawaii

Growing Ring-Spot Virus-free Papayas Using Anti-transpirants and Other Sustainable Techniques (1997)
Producer: Jon Biloon
Location: Captain Cook, Hawaii
Grant Award: $4,000
Summary: The papaya industry in Hawaii is currently devastated by ring-spot virus. This project proposes to control the virus' vectors, aphids and leafhoppers, by using better planting design, employing yellow sticky traps and coating the plants with an organic predator repellents. If successful, healthy revival of the papaya industry could result without the current slash and burn method of seeking virus-free planting areas.

Sustainable Alternatives to Herbicide for Weed Control: Using Cover Crops to Combat Panicum repens and Panicum maximum in Lowland, Eastern Hawaii (1997)
Producer: Paul D. Acciavatti
Location: Hakalau, Hawaii
Grant Award: $3,500
Summary: Two African grasses, Wainaku grass and Guinea grass, are intractable weeds in Hawaii because of their fibrous rhizomes. The common method of control is repeated applications of herbicide. Alternatively, this producer proposes to use one initial application of herbicide to clear a field and thereafter to use leguminous cover crops as rotation crops and living mulches to control these perennial grasses.

Sustainable Greenhouse Tomato Production: Evaluating Alternatives to Pesticides for Controlling Tomato Pinworm Larvae in Hawaii (1996)
Producer: Shari Tresky
Location: Hakalau, Hawaii; Grant Award: $3,520

Idaho

Non-irrigated Alfalfa Performance Trial (1997)
Producer: Christina Crawford
Location: Benewah County, Idaho
Grant Award: $3,500
Summary: Alfalfa, while valued at twice the price of local grass hay, has been difficult to grow in this area because of winter kill and pea aphid destruction. This project will test ten varieties of alfalfa for their hardiness and resistance to pea aphids without using pesticides or herbicides. If a non-irrigated, hardy, disease resistance alfalfa grown with sustainable practices shows success, many small farms could benefit by improving soil quality, reducing the use of chemicals, improving quality and yield and increasing their income.

Paradise Time-Controlled Grazing (1997)
Producers: Mark and Wendy Pratt
Location: Blackfoot, Idaho
Grant Award: $5,000
Summary: Many relatively unsuccessful techniques have been attempted to prevent the damage cattle do by congregating in riparian areas, particularly in late summer. Exclusion fencing, rotation grazing and riding are expensive and destroy the open range aesthetics. This project hopes to show that two cattle herders, using low stress handling practices, can train the cattle to graze in improved grazing patterns in different areas, thus reducing the impact on riparian areas while improving herd health. The cost of hiring the herders, which could be reduced to one once the animals were trained, would be offset by eliminating the need for fencing and fence maintenance.

Systems Thinking in a Range Environment (1997)
Producers: Jay Black and Joel Hermann
Location: Hammet, Idaho
Grant Award: $5,000
Summary: Cattle ranchers are increasingly pressured by environmentalists and new federal grazing regulations to change their ways. These producers hope to demonstrate a variety of more natural methods of managing range cattle, including a low stress weaning process that simply and quietly separates cows and calves for several days on opposite sides of a fence, comparison of four different land treatments of crested wheatgrass to improve diversity, controlling weeds and insects using animal impact and using cattle to spread seeds to reintroduce native species into designated areas. A collaborative planning and management team of interested local and state members has been formed to promote these ideas, and these organizers hope to facilitate more meetings of this important group.

Economic Viability of Greenhouse Solarization (1996)
Producer: Larry Higgins
Location: Sandpoint, Idaho; Grant Award: $2,450

Biological Control in Idaho Alfalfa Seed Fields (1996)
Producer: Larry Sorenson
Location: Parma, Idaho; Grant Award: $5,000

Squash Bug Management through Introduction of Game Birds (1995)
Producer: Jill Kohler
Location: Eagle, Idaho; Grant Award: $2,740

Row Spacing Effect on Weed Suppression (1995)
Producer: Lee Griffiths
Location: Blackfoot, Idaho; Grant Award: $530

Developing an Idaho-Based Marketing Cooperative for Sustainably and Locally Grown Produce (1995)
Producer: Janie Burns
Location: Nampa, Idaho; Grant Award: $4,622

Montana

Green Manure / Cover Crop Combination Experiment (1996)
Producer: Rod Daniel
Location: Grantsdale, Montana; Grant Award: $1,923.15

Evaluation of Grass Species for Improved Pasture Management (1996)
Producer: Robert Lee
Location: Judith Gap, Montana; Grant Award: $4,800

Legume Grazing in Rotation with Small Grains (1996)
Producer: Jess Alger
Location: Denton, Montana; Grant Award: $4,000

Vegetative Changes through Alternative Water Sources (1996)
Producer: Dale Veseth
Location: Malta, Montana; Grant Award: $2,500

Carter-Fallon Forage Committee Range/Livestock Project (1995)
Producer: Randy Tunby
Location: Baker, Montana; Grant Award: $4,943

Managing a Living Mulch System in an Intensive Organic Vegetable Cropping Operation to Enhance Weed, Nutrient and Pest Management (1995)
Producer: Helen Atthowe
Location: Stevensville, Montana; Grant Award: $5,000

Influencing Elk and Livestock Riparian Use (1995)
Producer: Allen Carter
Location: Livingston, Montana; Grant Award: $4,750

New Mexico

Limiting Gopher Damage by Controlled Livestock Grazing (1997)
Producers: Matt Schneberger and Nicolas Ortega
Location: Winston, New Mexico
Grant Award: $3,500
Summary: Pocket gophers—not just cattle—have caused loss of forage production along upland riparian areas. These rodents farm their food to select for annual weeds at the expense of grasses, trees and shrubs, simultaneously increasing erosion and adding sediment to streams. It is proposed that time-controlled grazing schedules—comparing forage on four plots with and without gophers and/or cows—will dem that gopher activity is substantial and trolled grazing with cattle can redu damage.

Value-added Wheat Production (1997)
Producer: Tom Seibel
Location: Anton Chico, New Mexico
Grant Award: $3,500
Summary: This project aims to research the best bakery grade wheat varieties for growing in the local area and to encourage small farmers to plant wheat. Besides improving soil, planting wheat could boost income if economic incentives were developed through value-added markets for organic wheat bought by local and regional bakeries. With declining cattle business, farmers are seeking alternative income, yet this crop can even be grazed lightly during the winter and still harvested for grain in the summer. Additional markets exist for wheat straw and animal feed.

Increasing the Value of Irrigated Pastures (1996)
Producer: Darrell Baker
Location: Tucumcari, New Mexico; Grant Award: $4,200

Test Plot Demonstration for Organically Produced Small Grains, Phase II (1996)
Producer: Lonnie Roybal
Location: Costilla, New Mexico; Grant Award: $5,000

Test Plot Demonstration for Organically Produced Small Grains, Phase I (1995)
Producer: Lonnie Roybal
Location: Costilla, New Mexico; Grant Award: $5,000

Municipal Sludge and Legumes as Soil Builders (1995)
Producer: Pete Tatschl
Location: Tucumcari, New Mexico; Grant Award: $4,290

Gila Permitees Association Elk Study (1995)
Producer: Matt Schneberger
Location: Winston, New Mexico; Grant Award: $5,000

Oregon

Constructed Wetland for Waste Water Treatment (1997)
Producer: Gary Shull
Location: Coquille, Oregon
Grant Award: $3,200
Summary: A low-maintenance, constructed wetland has the potential to clean dilute water waste from a dairy's feeding area or lot runoff so that it can be discharged directly to streams. Such wetlands can trap pollutants and organic litter, and microorganisms in the system use and transform compounds. This project hopes a model will demonstrate the idea to other local dairies as a sustainable way of preventing pollution of water resources.

Using Goats to Control Juniper, Sage and Rabbit Brush (1997)
Producer: Ann R. Snyder
Location: Powell Butte, Oregon
Grant Award: $3,500
Summary: For many years juniper, sage and rabbit brush have been encroaching on native grasses on rangeland. As a simple, inexpensive alternative to traditional methods of cutting, burning and spraying these plants, this project aims to show that intensive grazing by Angora goats can effectively control these weed species and thus promote survival of the native grasses.

Using Truffles to Enhance Douglas Fir Production on a Small Family Farm (1997)
Producer: Tim Grant
Location: Eddyville, Oregon
Grant Award: $2,800
Summary: This project will focus on increasing timber production and developing a new cash crop by experimenting with the symbiotic relationship of truffles and Douglas fir trees. Most truffles are mycorrhyzal with other plants, especially trees, providing mineral nutrients and water in exchange for sugars, so they could supplement forest health as well as the economic wellbeing of many small coastal farms.

Reducing Foxtail in Permanent Pastures
Producer: Kathleen Panner
Location: Riddle, Oregon
Grant Award: $3,500
Summary: Foxtail, a weed grass that causes significant economic and environmental damage to permanent pasture, has been invading the Umpqua Valley at an alarming rate. This weed reduces grazable and harvestable tonnage, lowers feed quality and injures animals when the seed enters their ears, eyes, noses and throats. Current methods of elimination include using non-selective chemicals or fully tilling and replanting fields. This project hopes to demonstrate the lowest effective level of application of Roundup, the most appropriate time of this application and the best grasses and appropriate seeding rates thereof to outcompete the foxtail and thus restore permanent pasture.

Biological Control of Pear Pests (1997)
Producer: George Ing
Location: Hood River, Oregon
Grant Award: $5,000
Summary: This producer has had excellent success controlling pear pests, specifically pear psylla, by using different mowing schedules and thus creating an understory that harbors a mix of natural predators. He would like to quantify the exact nature of the relationship between understory plants and important natural enemies of insects that infest pears.

School Cafeteria Compost System for Soil Amendment Production (1996)
Producer: Devon Strong
Location: Ashland, Oregon; Grant Award: $3,000

Grazing Sheep in New Forest Plantings (1996)
Producer: Tom Lehman
Location: Corbett, Oregon; Grant Award: $1,575

Low Tillage Weed Control (1996)
Producer: Jim Fullmer
Location: Philomath, Oregon; Grant Award: $1,895

The Effect of Aerated Compost Teas on Disease Control in Blueberries and Tomatoes (1996)
Producer: Jack Gray
Location: Noti, Oregon; Grant Award: $2,610

Use of an Aerated Compost Tea as a Preventive Foliar Fungicide on Grape Vines (1996)
Producer: Dave Michul
Location: Eugene, Oregon; Grant Award: $2,930

Use of Aerated Compost Teas for Control of Foliar Diseases of Spinach, Lettuce and Broccoli and to Promote Plant Vigor and Quality (1996)
Producer: William Booth / Debra Martin
Location: Blachly, Oregon; Grant Award: $2,620

Evaluating Methods to Enhance Microbial Degradation of Residual Soil Contaminants (1995)
Producer: J.J. Haapala
Location: Junction City, Oregon; Grant Award: $5,000

Parasite and Nutrient Management of Composted Manure (1995)
Producer: Glenna Wilder
Location: Cornelius, Oregon; Grant Award: $1,225

Low Tillage Weed Control System (1995)
Producer: Jim Fullmer
Location: Philomath, Oregon; Grant Award: $1,600

Demonstration and Implementation of Integrated Fruit Production on Anjou Pears (1995)
Producer: Thom Nelson
Location: Odell, Oregon; Grant Award: $5,000

Utah

Alternative Cropping for the Navajo Reservation (1997)
Producer: Mark Maryboy
Location: Montezuma, Creek, Utah
Grant Award: $4,300
Summary: Many small farms on the Navajo reservation could improve their family incomes by raising melons and fruit such as peaches and apricots, which depend more on labor than machinery for management. The desired crop, alfalfa, is not feasible because it requires expensive equipment and larger plots than are available. This project hopes to demonstrate the feasibility of these alternative crops.

Increased Forage Production during Alfalfa Crop Rotation Years in Johnson Canyon, Utah (1997)
Producer: Michael E. Noel
Location: Kanab, Utah
Grant Award: $2,900
Summary: A shortened growing period and cooler temperatures in this area south of Bryce Canyon mean that when oats are planted for one of every five or six years before an alfalfa field is plowed and replanted, grazing of the hay fields by livestock is limited by the need to get a new crop in. This producer hopes to determine whether a different grain such as triticale would be a better intermediate crop and whether oats could be interplanted as a cover crop in the springtime, perhaps reducing weed production and increasing yields. Eradication of two troublesome weeds, scotch thistle and bull thistle, will also be attempted using a defoliating beetle.

Pasture Aeration and Fertilizer Study (1995)
Producer: Ken Carter
Location: Mt. Home, Utah; Grant Award: $2,480

Washington

Dryland Corn Production in Columbia and Walla Walla Counties (1997)
Producer: David Carlton
Location: Dayton, Washington
Grant Award: $3,000
Summary: This producer hopes to evaluate the feasibility of dryland production of grain corn in Columbia and Walla Walla counties, Washington. Farm tests plots in the representative growing areas will be expanded to use field scale equipment to identify the range of conditions where dryland corn will succeed. Although corn has not previously been grown as a dryland crop in this area, it appears that modern hybrid corn varieties, coupled with improved water use efficiency under a no-till/low-till conservation tillage system, will make this economically feasible. This approach may provide an alternate crop to present dependence on cool season grain, use of different classes of pesticides, broader seeding and harvest seasons and potential for using a continuous no-till/low-till system.

Release of the Predator Mite, Amblyseius fallacis, to Control Spider Mites in Red Raspberries (1997)
Producer: Brian Cieslar
Location: Lynden, Washington
Grant Award: $1,850
Summary: Although raspberry growers have shown interest in releasing predator mites to control destructive spider mites, pre-harvest field releases did not appear to effect sufficient control of the pests, probably because of incorrect timing or rate of releases. Most growers apply broad-spectrum insecticides before harvest to control fruit-contaminating insects, but researchers suspect this clean-up spray disrupts biological control of spider mites, leading to late season outbreaks of spider mites that then require one or two miticide applications. This project proposes to release higher rates of predator mites at the beginning of the harvest period when spider mites typically begin to increase. This release would follow pre-harvest clean-up sprays. This tactic may provide an alternative strategy for spider mite control that would reduce reliance on chemical pesticides usually needed for late season control.

Bamboo: Alternative Crop for Southwestern Washington (1997)
Producer: R. D. Northcraft
Location: Tenino, Washington
Grant Award: $2,000

Summary: This project will investigate the potential of bamboo as an alternative crop for southwestern Washington. Bamboo varieties will be tested and compared for plant growth, nutrient status of plants and soil, time to harvest and yields. Projected outcomes include variety recommendation for shoot and pole production and guidelines for sustainable practices and soil fertility management for commercial bamboo production.

Vegetation Management on Small Acreages Using Short Duration, Intensive, Rotational Grazing (1997)
Producer: Terry and Gayle Swagerty
Location: Evans, Washington
Grant Award: $2,043
Summary: This project aims to demonstrate to a growing number of small acreage owners the use of short duration, intensive, rotational grazing of irrigated pasture by sheep. This technique can reverse declining productivity of land caused when noxious weeds and less desirable vegetation crowd out good pasture grasses. Teaching small farmers to use this long-term sustainable tool can help them manage their natural resources without resorting to herbicides.

Reducing Labor for Small Farm Harvesting (1997)
Producer: Theres Critchley
Location: Shaw Island, Washington
Grant Award: $2,500
Summary: To reduce the time and effort spent harvesting hay on small, remote island farms, this project hopes to make inexpensive modifications to existing equipment and to harvesting schedules. Remoteness and high cost preclude hiring custom haying contractors, so this group proposes to build hay wagons from salvaged lumber and auto parts and to fabricate a hay baler extension.

Carrot Rust Fly Control (1996)
Producer: Betsie DeWreede
Location: Rochester, Washington; Grant Award: $1,150

Alternative Crop Production in a Direct Seed Annual Crop Intense Rotation Program (1996)
Producer: Karl Kupers
Location: Harrington, Washington; Grant Award: $4,400

Weed Control in Organic Apple Orchard (1996)
Producer: Gary Holwegner
Location: Sunnyside, Washington; Grant Award: $2,550

Organic versus Synthetic Fertilizer - Container Nursery Trials (1996)
Producer: Nils Sundquist
Location: Poulsbo, Washington; Grant Award: $4,575

Improved Nitrogen Utilization and Herbicide Reduction through Relay Intercropping (1996)
Producer: Gene Tinklenberg
Location: Lynden, Washington; Grant Award: $4,230

Relay / Cover Crop for Corn (1995)
Producer: Jerry Van der Veen
Location: Mt. Vernon, Washington; Grant Award: $5,000

Managing Riparian Areas with Remote Livestock Watering Facilities (1995)
Producer: Craig Boesel
Location: Winthrop, Washington; Grant Award: $5,000

Intensive Grazing in Asian Pear Orchards (1995)
Producer: R. Bruce Gregory
Location: Friday Harbor, Washington; Grant Award: $898.50

Wyoming

Tall Stature Grasses for Winter Grazing and Spring Calving (1996)
Producer: Matt Weber
Location: Baggs, Wyoming; Grant Award: $2,800

FLITNER Wetland Habitat Enhancement Project (1995)
Producer: Stan & Mary Flitner
Location: Greybull, Wyoming; Grant Award: $5,000

Integrated Management to Improve Rangeland Health and Reduce Noxious Weeds (1995)
Producer: Ogden Driskill
Location: Devils Tower, Wyoming; Grant Award: $5,000

Initiation of Integrated Management (1995)
Producer: Tom Bruce
Location: Newcastle, Wyoming; Grant Award: $5,000

Index of Progress Reports

By Topic or Number

Western Region

Sustainable Agriculture Research and Education

Following are two indexes of project "fact sheets" available in the 1997-98 Annual Report, or earlier editions of Western SARE annual reports. The project overviews are available individually or in a full packet.

The first index organizes the fact sheets by topic or commodity, with corresponding project numbers. This should help you locate efforts of particular interest. The second index provides a list in project number order.

If a project "fact sheet" is noted to have been published in an Annual Report prior to the 1997-98 edition, contact the public information office at (530) 752-5987 or kkelleher@ucdavis.edu for a copy of that piece.

INDEX BY TOPIC

A project may be appropriate for more than one category, however, each project is mentioned only once by topic.

Ranching, Crop/Livestock, Dairy

- *Development of Sustainable Crop and Livestock Production Systems for Land in the Conservation Reserve Program (CRP)*, SARE #93-33 (Annual results)
- *A Livestock Production System Less Reliant on the Use of Publicly Owned Lands*, SARE #95-06 (Annual results)
- *Sustainable Rangeland-Based Beef Cattle Production Systems*, SARE #95-07 (Annual results)
- *Public Land Grazing Permittees Under Pressure: Sustainability of Coping Strategies on Private Land*, SARE #95-15 (Annual results)
- *Extending the Grazing Season and Integrating Crops and Livestock to Sustain Small Farms and Ranches in the Southern Rockies*, SARE #95-18 (Annual results)
- *Controlled Grazing on Foothill Rangelands*, SARE #96-21 (Annual results)
- *Western Integrated Ranch/Farm Education*, SARE #94-034 (Annual results in 1996 Annual Report)
- *Grazing Strategies for Sustainable Ranching Systems in Western Semi-Arid Zones*, SARE #92-31 (Final results in 1996 Annual Report)
- *Calibration of the Pre-sidedress Soil Nitrate Test to Improve Nitrogen Management of Dairy Farms*, ACE #93-11 (Final results in 1996 Annual Report)
- *Specifying and Analyzing Whole Ranch Systems for Sustainable Range Livestock Reduction in Environmentally Sensitive Areas*, SARE #91-24 (Final results in 1994-95 Annual Report)

Sustainable Agriculture Systems

- *Evaluation and Design of Low-Input Sustainable Vegetable / Small Grain and Small Fruit Systems of Western Oregon and Washington*, SARE #88-1 (Final results in 1994-95 Annual Report)
- *Development and Evaluation of Indicators for Agro-ecosystem Health*, ACE #92-08 (Final results in 1994-95 Annual Report)
- *A High-Input Crop Production System in Coastal California as a Model for Developing Indicators of Agro-ecosystem Sustainability*, ACE #93-13 (Final results in 1994-95 Annual Report)

Cover Cropping

- *Legume Cover Crops in Fallow as an Integrated Crop/Livestock Alternative in the Northern and Central Great Plains,* SARE #94-06 (Annual results). Also see SARE #96-29.
- *Potential of a Corn/Annual Medic Intercropping System for Weed Control, Reduced Soil Erosion and Improved Forage Production,* SARE #96-29 (Annual results)
- *Influence of Cover Crop Vegetation on Symphylan Density in Vegetable Production Systems in the Pacific Northwest,* ACE #96-19. (See also ACE #94-33 in 1996 Annual Report.)
- *Fall-planted Cover Crops in Western Washington: A Model for Sustainability Assessment,* SARE #94-08 (Annual results in 1996 Annual Report)
- *A Cover Crop System for Vineyard Pest, Weed and Nutrition Management,* SARE #91-26 (Final results in 1994-95 Annual Report)
- *Introduction of Cover Crops into Annual Rotations in Northern California,* ACE #93-14 (Final results in 1994-95 Annual Report)

Soil Quality & Microbiology

- *Managing Soil Biota in Low-Input and Organic Farming Systems to Enhance Soil Fertility,* SARE #95-24 (Annual results). See also SARE #94-17.
- *A Comparison of Conventional, Low Input or Organic Farming Systems: Soil Biology, Soil Chemistry, Soil Physics, Energy Utilization, Economics and Risk,* SARE #94-17 (Final results) and SARE #96-12 (Annual results), a continuation of the project. See SARE #89-18. Commodities include tomatoes, corn, beans and wheat.
- *A Comparison of Conventional, Low Input and Organic Farming Systems: The Transition and Long Term Viability,* SARE #89-18. (Final results in 1994-95 Annual Report)
- *Role of Soil Microbial Biomass and Microbivorous Nematodes in Functioning of Sustainable Agriculture Systems,* ACE #92-07 (Final results in 1996 Annual Report).
- *Tillage Practices for Improving Nitrogen Cycling and Soil Quality (in agricultural-intensive vegetable production),* SARE #96-16 (Annual results). See ACE #92-06.
- *Cover Crops Incorporated with Reduced Tillage on Semi-Permanent Beds: Impacts on Nitrate Leaching, Soil Fertility, Pests and Farm Profitability,* ACE #92-06 (Final results in 1996 Annual Report)
- *Evaluation and Design of Low-Input Sustainable Vegetable / Small Grain and Small Fruit Systems of Western Oregon and Washington,* SARE #88-1 (Final results in 1994-95 Annual Report)
- *Canola and Rapeseed as Enhancers of Soil Nutrient Availability and Crop Productivity in Cereal Rotations,* ACE #91-03 (Final results in 1994-95 Annual Report)

Vegetables

- *Influence of Alternative Vegetable Systems on Beneficial Arthropods and Soil Biology Dynamics and Soil Quality Trajectory,* SARE #95-25 (Annual results)
- *Development and Demonstration of Integrated Vegetable Production Systems for the Maritime Pacific Northwest,* SARE #94-29 (Annual results in 1996 Annual Report)
- *Development of Sustainable Potato Production Systems for the Pacific Northwest,* SARE #91-29 (Final results in 1994-95 Annual Report)

Fruits

- *Apple Production Without the Input of Neuroactive Insecticides,* SARE #94-23 (Annual results)
- *Implementation and Assessment of Economic and Environmental Impact of a Weather Monitoring/Pest and Disease Risk Assessment Network in Commercial Pear Production in Oregon,* SARE #96-13 (Annual results)
- *Comparative Performance and Farm-level Function of Conventional and Certified Organic Apple Production Systems in California,* ACE #92-9 (Annual results in 1996 Annual Report)
- *Silvopastoral Options for Fruit Growers,* SARE #89-17 (Final results in 1994-95 Annual Report)

Grains

- *Identification of Management Practices and Cultivars for Organic Hard Winter Wheat Production,* SARE #96-32 (Annual results)

- *Low-Input Legume/Cereal Rotations for the Northern Great Plains-Intermountain Region*, SARE #89-14 (Final results in 1994-95 Annual Report)

Natural Resource Management, Including Soil Conservation

- *Reducing Environmental Contamination from Feedlot Manure in the South Platte River Basin through Agronomic, Economic and Social Analysis and Education*, SARE #96-07 (Annual results)
- *Compatibility of Livestock and Water Birds on Improved Pastures*, ACE #94-03 (Annual results)
- *The Impact of Riparian Vegetation Filters on Western Soil and Water Quality: Nonpoint-Source Pollutants from Range and Croplands*, ACE #96-14 (Annual results)
- *Range Monitoring in the Upper Stony Creek Watershed*, ACE #93-12 (Final results)
- *Cattle Grazing Dispersion Methods and Riparian Ecosystems*, ACE #95-102 (Final results)
- *Rotational Management of Wetlands and Cropland in the Tulelake Basin*, ACE #94-20 (Annual results in 1996 Annual Report)
- *Integration of Aquaculture Into an Irrigated Farm to Improve Efficiency of Water and Nutrient Use*, ACE #91-02 (Final results in 1994-95 Annual Report)

Alternative Pest Control: Insects, Weeds, Disease

- *Brassica Green Manure Systems for Weed, Nematode and Disease Control in Potatoes*, SARE #95-21 (Annual results)
- *Development of a Farm-Wide System for Control of Many of the Principal Lepidopterous Pests of Grapes and Tree Fruits Based on Disruption of Premating Pheromone Communication Between Male and Female Moths*, SARE #95-19 (Annual results)
- *Weed Suppression and Enhancement of Wildlife and Beneficial Insect Habitat in Center-Pivot-Irrigated Field Corners*, ACE #96-04 (Annual results)
- *Reduced Herbicide Use Through Mechanical Cultivation and Banding of Herbicides*, ACE #96-09 (Annual results)
- *Control of Leafy Spurge by Grazing Goats, A Demonstration*, ACE #96-13 (Annual results)
- *Non-Chemical Control of Bollworm and Pink Bollworm in Cotton and Automated Insect, Plant and Profit Analysis*, ACE #95-203 (Final results)
- *Development of a Farm-Wide System for Control of Many of the Principal Lepidopterous Pests of Tomatoes Based on Disruption of Premating-Pheromone Communication Between Male and Female Moths*, ACE #95-202 (Final results)
- *Soil Bacteria to Control Jointed Goatgrass in Integrated Cropping Systems*, ACE #91-05 (Final results in 1996 Annual Report)
- *Brassica Utilization in Sugarbeet Rotations for Biological Control of Cyst Nematode*, SARE #91-22 (Final results in 1994-95 Annual Report)
- *Development of Winter Wheat Cover Crop Systems for Weed Control in Potatoes*, SARE #91-27 (Final results in 1994-95 Annual Report)
- *A Multidisciplinary Approach to Evaluate and Aid the Transition from Conventional to Low Input Pest Management Systems in Stone Fruits*, SARE #91-28 (Final results in 1994-95 Annual Report)

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- *Management of an On-farm Composting System*, ACE #94-010 (Annual results in 1996 Annual Report)

Tropical Agriculture

- *Orchard Alley Cropping in the Subhumid Tropics*, ACE #95-103 (Annual results)
- *Evaluation of a Perennial Vegetable, Asparagus, as a New Commercial Crop for Hawaiian Farmers*, SARE #96-03 (Annual results)
- *Integrated Hog Farming and Market Gardening for Small Farmers in Tropical Areas of the Western Region*, SARE #92-02 (Final results in 1994-95 Annual Report)

Professional Development for Agricultural Professionals

PDP = Professional Development Program

- *Sustainable Noxious Weed Management on Northwestern Rangelands,* PDP #95-02 (Annual results)
- *Agency Personnel Training in Riparian Monitoring and Management of Wildlife and Livestock in the Intermountain West,* PDP #95-03 (Annual results)
- *Sustainable Integrated Range Livestock and Crop Production Systems,* PDP #95-08 (Annual results)
- *Sustainable Agriculture Training Project: A Model of Collaborative Learning,* PDP #95-12 (previously PDP #94-06) (Annual results) Audience: Montana, Idaho, Eastern Washington and Utah.
- *Improving Manure Management to Protect Water Quality in the Southwestern United States,* PDP #96-02 (Annual results)
- *Extension Faculty Learning with Farmers - A Seminar Series on Sustainable Agriculture,* PDP #96-04 (Annual results)
- *Sustainable Arid-Land Grazing Systems: Training for Managers of Public Lands and Reserves,* PDP #96-10 (Annual results)
- *Professional Training in Biologically Integrated Orchard Systems,* PDP #96-11 (Annual results)
- *Multidisciplinary On-site Training in Sustainable Agriculture,* PDP #94-03 (Final results). Companion project to SARE #94-17. Commodities include tomatoes, corn, wheat and beans.
- *Pacific Northwest Sustainable Agriculture Systems In-service Education Program,* PDP #94-08 (Final results in 1996 Annual Report)
- *Extension Sustainable Agriculture Training in Eight Western States,* PDP #94-18 (Final results in 1996 Annual Report)
- *Training Agents in On-farm Implementation of Sustainable Management Systems for Tropical Agriculture in Hawaii and the Pacific Region,* PDP #94-14 (Final results in 1996 Annual Report)

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- *The Sustainable Farming Quarterly, A Regional Newsletter,* SARE #92-04 (Final results in 1996 Annual Report)
- *Western Region Community Supported Agriculture Conference,* SARE #94-22 (Final results in 1996 Annual Report)
- *Permaculture Systems Pamphlet,* PDP #94-009 (Final results in 1996 Annual Report)
- *Educational Video on Watershed Management Practices for Pinyon-Juniper Ecosystems, "Restoring the Promise."* PDP #95-01 (Final results)
- *A Consortium-based Sustainable Agriculture: Training Curriculum Plan,* PDP #95-15 (Annual results)
- *Sustainable Soil Management — Educational Resources for Extension Professionals in California's San Joaquin Valley and Central Coast Regions,* PDP #96-09 (Annual results)
- *Farm Improvement Club Network for Sustainable Agriculture,* SARE #91-23 (Final results in 1994-95 Annual Report)
- *Educational Video and Management of Pinyon-Juniper Ecosystems: A New Approach,* ACE #93-10 (Final results in 1994-95 Annual Report)

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- *Four-Corners Navajo Nation Sustainable Agriculture Demonstration Project,* SARE #93-34 (Final results)
- *The Production of New, Existing and Native Crops under Conventional and Organic Production Practices in Costilla, Garcia and Taos Pueblo,* SARE #96-27 (Annual results)
- *Assisting Resource-Poor, Small-scale Farmers with Adoption of Low-Input Technologies at the Rural Development Center,* SARE #91-30 (Final results in 1994-95 Annual Report)

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- *Low-Input Legume/Cereal Rotations for the Northern Great Plains-Intermountain Region,* SARE #89-14 (Final results in 1994-95 Annual Report)

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- *Fall-planted Cover Crops in Western Washington: A Model for Sustainability Assessment,* SARE #94-08 (Annual results in 1996 Annual Report)
- *A Comparison of Conventional, Low Input or Organic Farming Systems: Soil Biology, Soil Chemistry, Soil Physics, Energy Utilization, Economics and Risk,* SARE #94-17 (Final results) and SARE #96-12 (Annual results), a continuation of the project. Also formerly known as SARE #89-18 in 1994-95 Annual Report. Commodities include tomatoes, corn, beans and wheat.
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- *Influence of Cover Crop Vegetation on Symphylan Density in Vegetable Production Systems in the Pacific Northwest,* ACE #96-19. (See also ACE #94-33 in 1996 Annual Report.)

Professional Development Program, PDP, Projects

- *Multidisciplinary On-site Training in Sustainable Agriculture,* PDP #94-03 (Final results). Companion project to SARE #94-17. Commodities include tomatoes, corn, wheat and beans.
- *Pacific Northwest Sustainable Agriculture Systems In-service Education Program,* PDP #94-08 (Final results in 1996 Annual Report)
- *Permaculture Systems Pamphlet,* PDP #94-09 (Final results in 1996 Annual Report)
- *Training Agents in On-farm Implementation of Sustainable Management Systems for Tropical Agriculture in Hawaii and the Pacific Region,* PDP #94-14 (Final results in 1996 Annual Report
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Western Region

Sustainable Agriculture Research and Education

Utah State University
ASTE Building
1500 North 800 East
Logan, Utah 84322-2310

Annual Results

SARE #93-33

Development of Sustainable Crop and Livestock Production Systems for Land in the Conservation Reserve Program (CRP)

Location:
New Mexico

Funding Period:
September, 1993 -

Grant Award:
$312,000

Project Investigator:
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Terry Canup, Agricultural Communications, NMSU

(Continued)

Objectives

The overall goal of the project is to develop economically viable crop and livestock production systems to extend the wildlife and environmental benefits of the Conservation Reserve Program (CRP) beyond the 10-year contract period while maintaining compatibility with existing production systems, established farmer goals and external production constraints.

1. Develop livestock grazing systems for the predominant grass species growing on CRP land.
2. Identify dryland cropping systems for converting CRP grassland to sustainable crop production.
3. Compare the potential environmental impacts of the production systems evaluated in Objectives 1 and 2 with traditional crop and livestock production systems and current use of CRP land.
4. Identify and demonstrate techniques for improving and maintaining wildlife habitat on CRP and post-CRP lands.
5. Conduct an economic evaluation of alternative production systems including (a) whole farm cost and return analysis, (b) short- and long-term profitability analysis and (c) risk analysis.
6. Determine the compatibility of potential production systems with existing production systems, established farmer goals and external production constraints.
7. Develop an information delivery component to (a) demonstrate various crop and livestock production systems and (b) disseminate scientific, technological and economic information to agricultural producers.

Abstract

The central focus of this project has been the evaluation of tillage and grazing options for land enrolled in the Conservation Reserve Program. Research on converting CRP grassland back to annual crop production has shown it will be difficult to obtain commercially viable grain sorghum or winter wheat yields during the initial years following conversion. Results have shown the herbicidal control of CRP grass will be difficult. If perennial grasses are to be controlled with tillage operations, adequate lead time must be provided.

On-site grazing trials have shown that when properly managed, weeping lovegrass can be successfully utilized for beef cattle grazing. Yearling steers and heifers have produced weight gains in excess of 2.5 lb/day during spring and early summer. Animal performance declines over the course of the grazing season. Pastures of weeping lovegrass are capable of supporting stocking densities up to five times greater than native rangeland.

Economic models for weeping lovegrass grazing show the optimal time to sell the grazing animals would be near traditional sale dates of mid-September to mid-October, depending on the grazing system considered. Expected economic returns from grazing ($4 to $10/acre) are comparable to those obtained from crop production when government program payments are excluded. Although the grazing of weeping lovegrass pastures by yearling cattle and returning CRP land to crop production have similar levels of expected profitability, neither option would yield rates of return that could be obtained from alternative investment alternatives.

A tract of weeping lovegrass was utilized for beef cattle grazing in 1994, 1995 and 1996. The area was divided into 10 pastures consisting of two replications of five grazing management treatments. The five grazing management treatments were as follows: 12-month continuous grazing (12-mo), 6-month continuous grazing (6-mo), heavy spring/fall grazing (S/F), heavy spring/fall grazing with fertilizer (S/F w/F) and a 6-pasture rotation grazing (Rot). The 12-month pastures were 60 acres in size, all other were 30 acres each. The S/F w/F pastures received a broadcast application of urea fertilizer (avg. 39 lb/ac N) prior

to the initiation of grazing each year. Animal weights were recorded periodically throughout the study and were used to evaluate animal performance under the various grazing treatments and at alternative times during the grazing season. ADG was the key measure of production estimated from the grazing trial data. Other measures of animal performance were algebraically estimated from the ADG functions.

The project aims to provide applied research results to CRP contract holders in New Mexico. Its 1996 Progress Report was mailed to nearly 1,700 individuals in spring 1997. Included with the progress report was an overview of the recently released CRP final rule and a CRP Decision Aid, including a worksheet for calculating a CRP breakeven bid. Other publications in 1997 include the following:

Byerley, Brandy K., AValuation of Permanent Pasture Production in New Mexico,@ M.S. Thesis, May 1997.

Byerley, Brandy K., James D. Libbin and Jerry M. Hawkes, AValuing Permanent Pasture in New Mexico,@ NMSU Agricultural Experiment Station Research Report, Accepted for publication, expected 1998.

Libbin, James D., Jerry M. Hawkes and Brandy K. Byerley, AValuing Permanent Pasture in New Mexico,@ Journal of the American Society of Farm Managers and Rural Appraisers. Accepted for publication, 1998.

Economic Analysis

Estimated ADG functions and other equations algebraically estimated from the ADG functions were used to develop economic models to estimate economic returns for alternative grazing systems. Additional programming is needed and in progress for the spring/fall model and for fertilized treatments. The continuous grazing model and rotational grazing model generally show positive economic returns from grazing weeping lovegrass pastures. There is little economic difference between the two grazing schemes provided an optimal marketing strategy is followed. Yearlings should be sold in mid-September for continuous grazing and in early-October for rotational grazing.

Additional work will be completed during spring 1998 on the economic analysis. This includes completion of the spring/fall grazing model; revision of historical NMSU crop budgets to evaluate the expected economic returns from crop production without government program payments, as anticipated for the future; and a relative risk assessment between the cropping and grazing alternatives.

Potential Contributions

The first significant change in CRP acreage occurred in October 1997. On that date, most of the land that was initially enrolled in the CRP was re-enrolled for another 10 year period. But, tens of thousands of acres in eastern New Mexico were either not re-enrolled or not accepted in the new CRP. Since the initial contracts did not expire until October 1, 1997, the impacts of this project have not yet been realized. As producers begin to convert CRP land to productive use, in the next few months, the impacts of this project will be realized.

It is expected that agricultural producers in eastern New Mexico and West Texas will utilize project information in their decision making process. Many producers have begun to graze lovegrass following the release of CRP contracts in fall 1997. The 1998 growing season will provide the first opportunity to assess farmer adoption of the practices evaluated by this project.

A complete set of operational recommendations is not available at this time. Operational recommendations and farmer decision aids will be available to producers once the economic analyses portion of the project is competed in spring 1998.

Reported in 1998

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Buck Allen, County Agent,
Harding County, New Mexico
Wallace Cox, County Agent,
Lea County, New Mexico
Jeff Bader, County Agent,
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Bard, New Mexico
Tommy Campsey,
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Annual Results

SARE #94-06

Legume Cover Crops in Fallow as an Integrated Crop/Livestock Alternative in the Northern and Central Great Plains

Location:
Wyoming and Colorado

Funding Period:
July 1994 -

Grant Award:
$160,000

Project Coordinator:
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Ronald H. Delaney, Plant Sciences, University of Wyoming
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Grant D. Jackson, Agronomy; Montana State University

Cooperators:
Gilbert Lindstrom, Farmer, Sterling, CO
Miltenberger Brother Farm, Stratton, CO
Francis Hruby, UW Res. And Ext. Ctr. Archer, Cheyenne, WY

Objectives

1. Determine the feasibility of utilizing peas as the forage component to integrate livestock into the wheat/summer fallow cropping system.(Wyoming).
2. Determine the efficiencies of water-use, biomass and N-fixation when incorporating peas into the wheat/corn/summer fallow cropping system.(Colorado).
3. Determine adaptation, water-use, biomass and soil nitrogen contribution of late-summer seeded legumes in the dryland spring wheat or barley/summer fallow rotations. (Montana)
4. Demonstrate the effectiveness of incorporating legumes into the agroecosystem through on-farm demonstrations, workshops, field tours and mass media for producers/extension/research and Soil Conservation Services personnel.

Abstract

In Wyoming, identical Austrian winter pea (AWP) rotation studies with winter wheat were started in 1994 and 1995. Wheat yield was obtained for all rotations (combinations of the two studies) in 1997. The grazed AWP/winter wheat rotation has shown rapid gains in wheat yield going from 19 percent in 1995 to 8 percent more than the fallow/wheat check in 1997. In 1996 the wheat yield was lost to hail. In 1997, lambs grazed fall planted AWP for 21 days in June with a stocking rate of 11.9 lambs/acre. Average daily gain was 0.44 lbs/day. Based on the data from these short-term rotations the net profit from the grazed AWP/winter wheat rotation is several-fold greater than from the fallow/winter wheat rotations. Soil water in the upper three feet of the soil profile in the Fall of 1997 (wheat planting time) was 7.53 inches following Fallow, 6.85 inches following winter wheat and 7.05 inches following grazed AWP. These small differences in fall soil moisture resulted from July and August precipitation, which is common in this region.

The wheat-corn-fallow rotations are established at both the Sterling and Stratton, Colorado sites. All phases of the rotation are present every year. After corn harvest we are experimenting with the insertion of peas into the fallow period for cover, nitrogen (N) contribution and livestock forage. Three scenarios were researched in 1997: 1. Austrian Winter pea (AWP) planted no-till in the fall after corn harvest and 2. Spring field pea (SFP) and AWP planted no-till in the early spring following corn harvest. Peas were allowed to grow until June, and at that point we remove differing amounts of the peas as forage. We measured total biomass of peas, N content of the pea forage and sample shallow roots to estimate the N contribution to the soil. We also kept record of the soil water usage by the peas and the amount of water accumulated in the fallow for the succeeding wheat crop. Fall planted AWP forage yields were 3490 and 1925 lbs/A at Sterling and Stratton, respectively. Spring planted AWP forage yields were 3400 and 2230 lbs/A at Sterling and Stratton, respectively. Spring peas, Trapper variety, yielded 2620 and 1970 lbs/A at Sterling and Stratton, respectively. SFP had more weed problems than AWP, because they grew more slowly. Kochia and Russian thistle biomass was a sizeable portion of the SFP yield at both sites. Production of peas in 1996 reduced 1997 wheat yields by 50 to 80 percent because of the extra water used from the system. Corn yields, two years after pea harvest, were not affected either positively or negatively by pea production. Field days were conducted at both sites in June 1997. Farmer interest was moderate to high, especially at the Stratton site.

In Montana, all plot research was finished in 1996; therefore, no new field research was initiated in 1997. However the results from Moccasin and the grain protein results from Bozeman and Rudyard were not reported last year. Grain yield at Moccasin was unaffected by the green manure treatments when compared to a fallow check. These yield results were similar to those reported from Bozeman and Rudyard. As was mentioned in the 1996 report, drought conditions during June, July and August reduced expected

yields. Grain protein content was not affected by the green manure treatments at Moccasin, Bozeman or Rudyard. These protein results are similar to those reported last year at the Conrad location. Even though research plots funded by this grant were not reviewed by producers in 1997, they were shown other annual legume research trials at Conrad and Moccasin. Acreage of pea and lentil crops for seed, hay or green manure continues to grow in Montana. Pea and lentil acreage for all uses reported to the USDA-FSA increased from 30,844 acres in 1996 to 42,827 acres in 1997. Grower demand for information has continued to increase with the increased acreage.

Three field days were held, one in Wyoming and two in Colorado. Several publication resulted. "Austrian Winter Peas for Dryland Green," An Agricultural Experiment Station Bulletin, was published in Manure. In addition, a graduate student theses was completed. Journal article(s) will be prepared in 1998.

One abstract, for the CCTA meetings in February and one Agricultural Experiment Station User Bulletin were published. A user bulletin and a scientific paper is anticipated in 1998 or 1999.

In Montana three popular articles were written during 1997 using results from various legume experiments. Results were used at several soil fertility oriented grower meetings and agency update workshops.

Economic Analysis

In Montana costs for green manure plantings vary with the year and specie and should be compared to fallow costs. Thus the number of tillage or herbicide spray operations that the green manure crop replaces is an important factor. If the green manure is planted around July 1, then two or three tillage operations needed for conventional fallow would be eliminated, saving $10 to $15/acre (assuming it costs $5/acre for tillage). If a late-seeded green manure planting costs around $10 to $15/acre and the effects of fallow and late-seeded green manure on the next crop are similar, the amount of N fixed would be "profit." The second crop following the green manure would be the beneficiary of the accumulated N, and its value would depend upon the price of fertilizer N (assume $0.20/lb of N; however, area N prices vary from $0.18 to $0.30/lb) and the efficiency of converting the organic N from the green manure to an available form (assume 50%). Thus N from the late-seeded green manure would be worth $4.50 to $15/acre assuming green manure dry matter yields of 0.75 to 2.5 tons/acre and a N content of 3 percent.

In Wyoming, based on the data from the short-term rotations, the net profit from the grazed AWP/winter wheat rotation is several-fold greater than from the fallow/winter wheat rotations. No economic analysis is meaningful at this stage of experimentation in Colorado.

Potential Contributions

Planting legumes in mid- to late-season in Montana to replace summer fallow can reduce annual soil erosion losses from 4 to 6 tons/acre, increase precipitation efficiency from 20 to 50 percent, prevent excessive precipitation from forming saline seep and eventually reduce fertilizer N costs from $4 to $15/acre.

Farmer Adoption and Direct Impact

Montana farmers probably will not plant legumes mid- to late-season unless they experience a cool, wet growing season. However the practice of planting legumes as a primary crop planted as early in the growing season to replace summer fallow continues to grow as shown by the increase in reported legume acres by USDA-FSA, number of companies contracting legume production and number of seed companies selling legume seed. The annual legume acreage will continue to grow in Montana, but the growth rate will depend upon seed and commodity prices. By substituting legumes for fallow, farmers can increase their planted acres, total farm production and gross income without increasing N fertilizer use.

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Annual Results

SARE #94-23

Apple Production Without the Input of Neuroactive Insecticides

Location:
Washington and Northern Oregon

Funding Period:
July 1994 –

Grant Award:
$268,000

Project Investigator:
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Cooperators:
Growers:
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Sue Naumes, Naumes Inc., Chelan, Washington
Chris and Chuck Peters, Peters Orchards Inc., Wapato, Washington
Dave Garretson, Lloyd Garretson Co., Yakima, Washington
Ken and Diana Bailey, Orchard View Farms, The Dalles, Oregon
Fieldmen / Consultants /

(Continued)

Objectives

1. Determine the densities of arthropod pests and associated natural enemies and the level of crop loss due to arthropods in apple orchards using control tactics that do not include the use of neuroactive insecticides.
2. Determine the impact of augmentative and/or innoculative releases of selected parasites on the control of codling moth and leafrollers and their compatibility with non-neuroactive insecticides used for pest control.
3. Determine the economics of producing fruit without neuroactive insecticides and the potential for specialty markets or any value-added to apples produced in this way.
4. Compare the level of neuroactive insecticides on fruit and in the soil in orchards using these products and those in the project not using them.
5. Determine the change in soil fauna composition through time in orchards using neuroactive insecticides and those not using them.
6. Demonstrate and educate members of the apple industry via field-days, popular journal or trade journal articles and presentations at grower meetings on the advantages and disadvantages of producing apples without the input of neuroactive insecticides.

Abstract

The purpose of this study is to directly compare the ecology and economics of delicious apple orchards managed without using neuroactive insecticides (NNAI) or managed conventionally (CONV). Six orchards were selected for the study, five in Washington (Bridgeport, Chelan, Orondo, Wapato, Yakima) and one in Oregon (The Dalles). Each orchard was divided into a 10 acre CONV block and a 10 acre NNAI block. Pheromones alone or pheromone plus an experimental insect growth regulator, tebufenozide (Confirm), were used as the primary control for codling moth in the NNAI orchards in 1997. These selective tactics were as effective as conventional azinphosmethyl (Guthion) sprays. A high density of codling moth at one site resulted in unacceptable levels of control in a portion of the NNAI block. However, fruit injury was confined to one acre on the upslope edge, with damage in the remainder of the block equivalent to that in the CONV block. Confirm also provided excellent control of leafrollers in NNAI blocks. Very low, near undetectable levels of leafroller activity and fruit damage were recorded in all NNAI orchards in 1997.

The experience in producing apple without the use of neuroactive insecticides has pointed to the urgent need to register alternative insecticides with modes of action like tebufenozide. Without this material crop losses in the NNAI orchards would have been 10 times what they were due to damage inflicted by codling moth and leafrollers. The implementation of the Food Quality Protection Act of 1996 promises to greatly reduce the availability of neuroactive insecticides in tree fruit crops. If left only with choices of "hard chemical" like synthetic pyrethroids or "organic" type products like rotenone, oils, or Bt products, pest control in orchards will be extremely difficult.

Other arthropod pests were generally at lower levels in NNAI than in CONV orchards. Three pest species, white apple leafhopper, green apple aphid and tentiform leafminer, reached population densities that required intervention with insecticides in at least one of the CONV orchards. In contrast, populations of natural enemies kept these pest in check in NNAI orchards. Mite and aphid predators, the leafminer parasitoid, Pnigalio flavipes and the leafhopper parasitoid, Anagrus sp., were especially abundant. The relative contribution of predators and parasitoids to suppression of secondary pests in NNAI blocks increased from 1996 to 1997. Some intervention with insecticides was required for control of secondary pests in 1996 (0.5 sprays/block), but no sprays were used in 1997. Three methods are being used to

document broader changes in arthropod biodiversity. A majority of the more than 3000 sweep net samples of the orchard ground cover and soil samples have been processed, with over a hundred families, mostly representing 8 orders of insects and mites identified to date. For both soil and sweep net samples, however, no clear patterns of change in biodiversity are evident. Results of pit fall trapping have revealed some consistent differences in biodiversity in NNAI and CONV orchards. Four groups comprised of mobile predators, earwigs, ground beetles, centipedes and spiders, were substantially more abundant in the NNAI than the CONV blocks. In contrast, similar numbers of springtails, snails and slugs, invertebrates that are herbivores or detritivores and less mobile than their predators, were captured in pit fall traps in the NNAI and CONV blocks. Greater exposure to pesticide residues as the more mobile predators forage on the soil surface and within the tree may account for the differences in abundances in NNAI and CONV blocks.

New pheromone trapping systems for monitoring leafrollers and campylomma were evaluated for the second consecutive year. Both systems show considerable promise as new tools for an apple IPM program. Pest management consultants will be evaluating the utility of these trapping systems in a large number of commercial orchards in 1998.

Project findings are being shared through conferences, workshops, field-days, trade journal articles and presentations at grower meetings. Presentations at scientific meetings included an invited talk to codling moth researchers in California and a poster at the Annual Meeting of the Entomological Society of America in Nashville, Tennessee. We are preparing a manuscript for submission to The Journal of Applied Entomology. Over 200 growers and consultants learned about this project during field-days this summer in the Columbia basin and Chelan. The findings of our project were presented to about 2,000 growers in a poster display at the annual meeting of the Washington State Horticultural Association. Over 5,000 farmers learned about this project in January 1997 as part of the Meet the Researchers poster program for the American Farm Bureau Federation's 78th annual convention in Nashville, Tennessee. Invited presentations on 'Production of Apples without the Input of Broad-spectrum Insecticides' at the Annual Meetings of the Western Colorado and Idaho State Horticultural Societies exposed an additional 400 growers to this project. A workshop will be held in January of 1997 focusing on recent advances in orchard IPM programs. The first in a series of IPM continuing education courses will be held in the second week of February, focusing on the ecology of orchard systems. An article outlining the progress of this SARE project was published in the Good Fruit Grower, the most widely read magazine on fruit production in the world..

Economic Analysis

Over the course of this three-year project, the cost of pest control in CONV blocks has remained the same, while in NNAI blocks it has steadily declined The cost of the NNAI control program should decline even further as growers cut the pheromone application rate. This is the trend in a majority of Washington apple orchards, with approximately 50 percent of the acreage treated with 200 dispensers per acre (d/a) rather than the label rate of 400 d/a. in 1997.

Potential Contributions

A major benefit of not applying neuroactive insecticides is the increase in arthropod species diversity. While diversity for the sake of diversity is of little value to the apple producer, diversity that exhibits itself as increased biological control or the potential for increased biological control is of great value. This project has demonstrated that natural enemies of several apple pests were significantly more abundant in NNAI than CONV orchards. At some sites, biological control of aphids and leafminers was achieved in the NNAI orchard, while growers intervened with an insecticide in the CONV orchard. Results of pit fall trapping have revealed some consistent differences in arthropod biodiversity in NNAI and CONV orchards. Ground beetles were the most abundant group of predators in most NNAI orchards throughout the season. Population densities of this important group of predators were consistently lower in CONV than NNAI orchards. Predatory ground beetles can play a major role in suppressing populations of pests that overwinter in the soil or low on the tree, including codling moth and cutworms.

Farmer Adoption and Direct Impact

The use of pheromone, bacterial insecticides and other selective tactics for control of apple pests is becoming more widespread in Washington, as the threat of resistance to conventional insecticides increases and the value of preserving natural enemies becomes more widely known. The acreage treated with pheromones for CM control in Washington increased from 22,000 acres in 1996 to over 28,000 acres in 1997. We predict that pheromone will be applied as the primary control for codling moth on up to 35,000 acres of apples in Washington in 1998. Studies have indicated up to a 60 percent reduction in the use of organophosphate insecticides for CM control in areas treated with CM pheromone products.

Producer Involvement

Six producers and several pest management consultants are involved in our project. Major fruit producers in the project include Dole Inc., an internationally recognized fruit company, and Naumes, Inc., the largest producer of pears in the world.

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Orchard Managers:
Jim Hagel and Steve Scheib, Arrowhead Ranch, Bridgeport, Washington
Nick Stephens and Andy Kahn, Northwest IPM, Inc., Wentachee, Washington
David Smith, Naumes Inc., Chelan, Washington
Tom Gausman, Dole Inc., Wells &Wade Fruit Co., Wenatchee, Washington
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Annual Results

SARE #95-06

A Livestock Production System Less Reliant on the Use of Publicly Owned Lands

Location:
Utah

Grant Award:
$60,000

Funding Period:
July 1995 –

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Verl L. Bagley, County Extension Agent, Utah State University
W. Craig Burrell, Extension Livestock Specialist, Utah State University

Cooperators:
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Hardy Redd, LaSal Cattle Company, LaSal, Utah
Van Willey, Willey Ranch, Antimony, Utah
Lee Wood, Wood Ranch, Cedar City, Utah

Objectives

1. Develop a year around beef cattle and/or sheep production system that will allow farmers and ranchers in areas where public land use issues may result in curtailment of livestock grazing to remain in the livestock production business.
2. Determine the effects of an accelerated calf and/or lamb growth production system on the longevity of mother cows and ewes as well as the economic ramifications of this change. The wellbeing of the mother cows and ewes nurturing offspring capable of accelerated growth could also a factor.
3. Determine the efficiency of cattle and sheep production under an accelerated calf/lamb growth system on improved and unimproved pastures and meadows.
4. Develop a system to efficiently and effectively disseminate information from this study to farmers and ranchers.

Abstract

During January of 1996 an extension agent from Emery County, Utah, brought a group of producers from his area to observe current research projects being conducted at USU's Logan Agricultural Experiment Station. During the discussion that ensued following the tour of this project, one of the producers suggested early weaning of the rapid-growth calves may be more efficient than allowing the calves to remain with their dams until normal weaning time. It was decided that this hypothesis would be tested. The strategy was simple. Rapid-growth calves were stratified into two similar groups based on body weight, sex and sire. One group was weaned early (September 15, 1997) while the other group remained with their dams until weaned at the normal time of October 31, 1997. The early-weaned calves were simply removed from their dams and placed in a drylot with free-choice access creep feed and average-quality alfalfa hay. The dams of the early-weaned calves received free-choice access to average-quality forage. By normal weaning time early-weaned calves were 8.5% heavier than those remaining on pasture with their dams (816 versus 752 lbs.). An accounting of metabolizable energy (ME) inputs for both cows and calves showed the early-weaning system to be 45.62% more efficient (8.24 versus 12.00 Mcal ME/lb. calf gain). Most of the difference in ME input appeared to be due to the higher intake of lactating cows versus dry cows.

Impending curtailment of the grazing of public lands has prompted many states in the Intermountain West to form pasture committees. Input from farmers and ranchers to these committees indicate that information is needed on production efficiency on pastures and meadows before and after improvement and/or renovation. This information will aid farmers and ranchers in making decisions as to improvements necessary to remain economically viable.

Information gained from this study will be disseminated through an annual written report distributed via the cooperative extension service in the Intermountain West. The system would also involve annual field days and visits to demonstration sites arranged through the cooperative extension service. Field days would involve presentation of data with question and answer periods as well as on-site visits to observe pastures and animals. There will be demonstration herds in strategic areas that typify production parameters on privately owned pastures and meadows in the Intermountain West and annual field day visits to each of the demonstration herds.

Economic Analysis

The economic aspect of an accelerated calf and/or lamb growth production system on the longevity of mother cows and ewes is related to the fact that a major portion of the annual cow/ewe cost is associated with the development of replacements. An increased replacement rate would thus have economic ramifications.

Potential Contributions

The impaets of this project are hypothesized to be mainly on farm-ranch economy. The reviewer is referred to the last page of the summary attached at the end of this report. These are actual costs associated with the study conducted at the Experiment Station this past year. Some costs had to be estimated due to the fact that the study was conducted at a university setting, i.e. land ownership costs. These estimates indicated a net return per cow of $164. There could be environment impacts associated with this project as it stresses efficient use of privately-owned pastures and meadows, which would likely reduce grazing pressure on publicly owned lands while maintaining the economical viability of the producer.

Farmer Adoption and Direct Impacts

This subject will not be able to be addressed until the conclusion of the demonstration herd portion of the study. At the inception of the project, it was felt that farmers and ranchers would best be served and convinced by on-ranch demonstrations followed by summary field days. As mentioned earlier, four demonstrations have been developed. Nearly 400 calves will be born this coming spring (1997) that are associated with this project.

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Annual Results

SARE #95-07

Sustainable Rangeland Based Beef Cattle Production Systems

Location:
Wyoming

Funding period:
July 1995 -

Grant Award:
$155,260

Project Investigator:
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Cooperators
(Ranchers, all in Wyoming):
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Scott Sims, S&S Ranch Co. McFadden
Jack Turnell, Pitchfork Ranch, Meeteetsee
Greg Simmonds, Deseret Ranches, Cody
John Nunn, Needmore Land & Cattle Inc, Laramie
Troy Stafford, Riverton
Pete Scott, Two Bar Ranch, Casper
Kelly Land and Cattle Company, Saratoga

Objectives

1. Determine animal productivity, feed requirements, economic characteristics and inherent risks of herds calved at conventional early dates and later spring dates from a) cooperator ranch herd records and during the period of this study and b) experimentally from a portion of the University herd during the period of this study.
2. Determine the production and economic characteristics along with the financial feasibility of alternative winter forage resources or hay processing techniques, including baled or stacked hay, windrowing hay only and feeding from the windrow, and pastures planted to species such as Basin wildrye (Elymus cinerius) that provides forage accessible to cattle even with snow cover.
3. Conduct a technology transfer program that includes workshops, seminars and/or ranch tours, Extension publications, popular press and trade publication articles, news releases and refereed journal articles.

Abstract

The purposes of the project are to a) determine the differences between conventional late winter and late spring calving dates in the productivity, feed requirements, economic characteristics and risks; b) determine production and economic characteristics of alternative winter forage and hay processing techniques; and c) conduct technology transfer programs to convey results to producer and other audiences. This project funding has been underway for two funding years. The experimental portion has provided preliminary results and the producer information surveys and economic analysis have been initiated. Technology transfer activities have been implemented.

Conventional and late breeding seasons were initiated on an experimental University owned herd in 1995. Weaning weights of these calves in falls 1996 and 1997 shows a small advantage for the earlier calving dates. However the additional weight probably is not sufficiently large to compensate for the additional winter feeding required to support cows nutritional needs for conventional late winter calving dates and the lower labor and higher percentage of calves weaned provide additional benefits.

Historically, producers have attempted to increase profitability with earlier calving dates and accelerated feeding and supplementation programs, thereby increasing weaning weights. This manipulation tends to increase the stress on the cow herd as well as production costs. Calving in late winter/early spring has eliminated the synchronization of the cow production cycle and the natural nutrient availability cycle of the forage. This forces producers to increase inputs such as hay, supplements, labor and medical expenses. However, in today's market the cow/calf producer regardless of operation size must find ways to reduce the inputs in order to remain viable. One solution to help reduce inputs is to calve later in the spring, to coincide with the growth and availability of green, lush, spring forage. This adjustment should help producers optimize the use of their static land and forage base resource, reduce the impact of environmental stress, labor and supplementation needs for their cattle herd.

The average calving date for the past two years (1996 and 1997) was March 11 for the early calvers vs. May 15 for the late calvers. As can be expected, bull calves were heavier than heifer calves at birth (87.61 vs. 81.75 lbs). Late calves were significantly heavier than early calves at birth (86.76 vs. 80.72 lbs); moreover, late calving cows exhibited lower calf morbidity rates (6% vs. 10%). The heavier birth weights observed, for the late calves, were possibly a result of increased protein intake from the grazed forage during the pre-calving period.

Early calving cows showed greater fluctuations in body weight throughout the summer grazing season, starting with higher initial weights and gaining more during the summer. This may be a result of varia-

tions in milk production between the two groups during this time period. The early calvers should be on the decreasing side of the milk production curve while the late calvers are on the increasing side and reach peak production sometime around late July.

Case studies with data of selected cooperating ranches are in preparation describing management strategies and results of implementing late season calving. Operating costs and return to capitol on case ranches have been achieved or projected to reach $0.45 to 0.50 per pound of marketed stocker calf compared to $0.80 to1.00/lb for operators calving at conventional times. Economic analysis of selected alternative means of providing winter forages are underway. Technology transfer efforts have included a presentation to the Wyoming Stock Growers annual meeting concerning the late calving concept and economic hypothesis supporting the concept. In addition, two articles were prepared for and published or are in press for livestock producer weekly and monthly publications such as Wyoming Cow Country and Wyoming Stockman Farmer.

Potential Contributions

We have attempted to provide as much economic information to ranchers as available. In general, late calving as compared to conventional northern region calving dates appears to provide as good or better economic returns to ranchers. In addition non-farm resources and labor input to the operation will be reduced while management of basic ranch resources, grazable forages, will be intensified. An implied shift to more winter grazing will relieve growing season grazing pressure on rangelands with possible implications of improving ecological condition and watershed stability. These changes will reduce the risk of negative cash flows induced by fluctuations in cattle markets or unexpected increases in operational costs such as for supplemental feeds, equipment, or fuel.

New Hypotheses

The largest concern after economic returns of most ranchers confronted with the proposal to shift calving seasons is how to modify their grazing program especially on public land allotments. There may be opportunities for research into appropriate stocking rates and season of grazing effects due to newer grazing strategies.

Farmer Comments

Our cooperators who calve in May and June in our area express great satisfaction with the results they have achieved. Other more numerous ranchers who have shifted calving from March or earlier to April report that calf weights have not changed while they have reduced their winter feeding by at least a month from the five to six months previously.

Reported in 1998

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Annual Results

SARE #95-15

Public-Land Grazing Permittees Under Pressure: Sustainability of Coping Strategies on Private Land

Location:
Utah

Funding Period:
July 1996 -

Grant Award:
$63,000

Project Investigator:
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Cooperators:
This project has used a telephone survey approach to collect information on whole-ranch operations. About 192 ranchers were contacted this year, and they therefore qualify as cooperators.

Objectives

1. Confirm findings of Birkenfeld (1994) with respect to the proportions of proactive and passive permittees and determine the factor(s) that distinguish these two groups.
2. Determine the coping strategies that proactive producers use to intensify or diversify their operations, determine why such options are chosen and classify and rank common strategies in terms of economic, environmental and social criteria for sustainability.
3. Determine optimal patterns of ranch resource allocation (i.e., land, labor, capital, etc.) That would allow operations to simultaneously satisfy economic, environmental and social criteria for sustainability.
4. Determine critical constraints and trade-offs that prevent all sustainability criteria from being met and identify technical or policy innovations that would help producers overcome constraints.
5. Communicate findings and recommendations to producers, researchers, extension and policy makers.

Abstract

The overall purpose of this project is to determine the extent to which large-scale changes in management are occurring on privately owned grazing lands in Utah. Specifically, this includes identification of the types, extent and causes of management change, the likely sustainability of new management practices and implications for increased demand for technological and management innovations. Conventional wisdom in the early 1990s suggested that adoption of an aggressive "Range Reform" policy by the Clinton Administration had intensified fear among western range livestock producers that they would soon lose access to public grazing lands. The average Utah public land permittee typically runs about 40 percent of his or her animal unit months (AUMs) on public grazing each year, which illustrates the high level of economic dependence such operators have on public land resources. Permittees are also a large component of range livestock producers in states such as Utah. It was thought that the acute fear of losing access to public land would encourage range livestock producers to intensify or otherwise alter their use of private land in order to increase carrying capacity as a compensatory survival tactic. Intensified use of private land would mean that demand for new technology and management systems would suddenly increase— this could include heightened interest in things like pasture forages, irrigation systems and educational materials on short-duration grazing and range management innovations. It has been generally thought that over the past decades private grazing lands in the Intermountain West have been an underutilized and relatively ignored, high-value resource, ripe for major gains in productivity that could enhance animal agriculture in Utah. Understanding what drives producers to make changes and what characterizes innovative managers, is important to help promote sustainability of agriculture in general and is the core theme of our project.

Our project is primarily based on social survey and economic analysis across large segments of the producer population in Utah. To-date the following has been accomplished:

With funding from SARE and Utah State University, one socioeconomic survey of 192 Utah grazing permittees, each dependent on a mix of private and public lands, has been completed with the data fully analyzed and a master's thesis written and defended. With other leveraged funding from the EPA, a similar socioeconomic survey of another 200 Utah producers, dependent solely on private lands, has been completed in terms of data collection, with analysis of results slated for early 1998. A student research proposal for a detailed economic risk analysis of private land intensification among permittees is nearly complete, with data collection for this effort planned for early 1998. The rationale for having the two surveys of different subpopulations of land managers was to see if the subpopulation dependent on public

land would be engaged in more private land improvements (as a response to shifts in federal grazing policy) compared to the subpopulation that is solely dependent on private land.

In summary, producer strategies are dynamic over time. In the case of improved management of private grazing lands, adoption of new technology or management practices is not linear but rather episodic in nature. Downturns or up-turns in pro-active behavior across the population can be influenced by coincidences in micro-economic, macro-economic, demographic and policy factors. For example, as long as federal policy on use of public grazing remains vague, vacillates, or supports the status quo, most permittees can be expected to remain as passive managers. As they continue to age and are not replaced by younger producers, passivity will continue to increase. Policies and factors that contribute to uncertainty in prices for animal products (i.e., such as free trade) may also contribute to economic disincentives for many producers to invest in improved land management for production, especially if economically superior options off-ranch compete for their investment dollars.

Site Information

This project is concerned with a wide variety of landscapes typical for the Intermountain West. The project deals with socioeconomic survey methods, not plants and soils per se.

Potential Contributions

The impact of our project can only be addressed in terms of the final recommendations for policy makers with the goal of better formulating policy that enhances the sustainability of ranching in the Intermountain West. Prominently this will probably include more attention to policies that encourage a younger generation to take up ranching, make cost-share monies more available to producers, assist producers in better-managing risk and diversifying income and reducing the cost of important grazing-based technologies.

Farmer Adoption and Direct Impact

This is not a technology-generation project per se but rather an investigation of who seeks innovations, when and why. We hope to make policy recommendations that facilitate appropriate adoption of new technology and management systems. While these numbers are low they are reality. Low rates of adoption may be entirely appropriate under conditions of high economic risk and uncertainty (and high year-to-year environmental variation) when the economic wellbeing of most producers is already in a high-challenge situation. Indeed, those conservative producers who refrain from making risky investments in new technology may be the most sustainable producers when all is said and done ten years from now. We are revealing that policy, demographic and economic forces, many beyond our control, likely dictate rates of technology adoption as they pertain to large-scale changes in the management of private grazing lands—in most cases just having new technology on the shelf will not elevate adoption rates. Our work in year 3 is devoted to analyzing the economic risks and returns to management intensification of private grazing lands. We expect to find that most low and middle-income ranchers would be unable to tolerate the risk involved in substantive, intensified use of private grazing lands in Utah. Risk-neutral producers who are wealthier tend to be the self-selected innovators. Coercing others to adopt new management systems under uncertainty or risk may lead to the economic demise of marginal operations.

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Annual Results

SARE #95-18

Extending the Grazing Season and Integrating Crops and Livestock to Sustain Small Farms and Ranches in the Southern Rockies

Location:
New Mexico and Colorado

Funding Period:
July 1995 -

Grant Award:
$141,602

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(Continued)

Objectives

1. To determine the ability of forage Brassicas and oats (Avena sativa L.) to provide late-season forage and hairy vetch and winter rye (Secale cereale L.) to provide early-season forage, when overseeded into sweet corn stalks.
2. To determine the profitability of overseeding forage Brassicas, oats, hairy vetch and winter rye into sweet corn stalks in terms of heifer average daily gain.
3. To determine the ability of forage Brassicas and spring oats overseeded into established pastures to provide increased late-season forage.
4. To disseminate the results of the project to farmers and ranchers.

Abstract

The primary goal of our project is to develop forage production systems that extend the grazing season in the fall and provide more forage in the spring through overseeding of vegetable crops and irrigated pastures and increased integration of crops and livestock. Overseeded species tested have included forage Brassicas, hairy vetch, winter rye, spring and winter oats and triticale. The project includes a grazing study to determine the profitability of overseeding several of these crops into sweet corn to increase the forage value of the stover after sweet corn harvest. In this grazing study, the first complete cycle of grazing was completed in fall 1996 and spring 1997. Although profitability of overseeding into the corn has not yet been determined, production data from this first cycle showed stocker heifers in fall gained an average of 0.6 pound/day more grazing corn stover interseeded with turnips (1.6 pounds/day gained) than when grazing corn stover alone (1.0 pound/day gained). Trials have been carried out at various farmer/rancher cooperator sites throughout the region and at the Alcalde Center in which pastures have been overseeded with various summer- and/or winter-annual forages. Establishment of the annual forages has ranged from poor at some sites to excellent at other sites.

Crop residues are frequently grazed to add economic value to them. However, they are generally of low forage quality. Sweet corn in particular is a high-value vegetable crop that leaves significant amounts of residue after the ears are harvested. Overseeding a second crop of high forage quality into the corn could potentially increase the ability of these residues to support livestock. Sweet corn was overseeded with annual forages in July of 1996. The first complete cycle of grazing was completed in fall 1996 and spring 1997. Grazing treatments were corn stover alone, stover+oats and stover+turnips for fall, grazed from mid-November to mid-December. Stover+rye was grazed from mid-April to mid-May, and stover+hairy vetch was grazed from mid-April to late May. Stocker heifer average daily gains were 1.01, 1.21, 1.69, 1.54 and 1.28 pounds/day for the control, oats, turnip, rye and hairy vetch treatments, respectively; total gains per acre during the grazing periods averaged 160, 196, 264, 244 and 269 pounds/acre, respectively (stocking rates were about 5 heifers/acre). These results indicate that interseeding annual forages can add feed value to sweet corn stover resulting in a more productive use of a given piece of land; however, the study will need to be carried out for at least one more cycle in order to confirm these first-year results.

Not unexpectedly, and consistent with information in the literature, overseeding annual forages into irrigated pastures without herbicides and/or expensive no-till seeding equipment is the most difficult part of the project. However, for most of the producers in the region who have irrigated pastures or meadows, this is one of the few practices they would be able and/or willing to undertake to extend the grazing season on these fields. In 1997, we were able to overseed into New Mexico pastures at or near Abiquiu, Nambe, Canjilon and Zuni Pueblo. Some of the overseeded forages have the potential to overwinter and thus potentially provide increased forage the following spring. For example, hairy vetch, rye and turnip were seeded during summer 1996 at Canjilon. Although observations indicated little growth had oc-

curred by fall 1996, samples taken from this site the following June showed more significant growth for the hairy vetch and rye. In fact, we are finding through these trials that the use of winter-annual forages, especially in the higher elevations where growing seasons are shorter, may offer a better chance to extend the grazing season of pastures through increased productivity the following spring or summer.

Site Information

General characteristics of all sites include soil types that are variable but generally clay loams to sandy loams, with a high-desert climate and elevations of 5,700 to7,000 feet and 9 to 14 inches of precipitation per year as rain and snow. Total holdings of farmer/rancher cooperators range from 2 to 25 acres. The area is mountainous, but field sites are graded with fairly uniform, gradual slopes. Most farmers and ranchers have off-farm employment.

Potential Contributions

Although we are early in the project and do not have enough field data to make conclusive statements regarding positive benefits or impacts, first-year results from the grazing study indicate that livestock may have the potential for substantially higher daily gains when grazing corn stover overseeded with turnips than when grazing the stover alone (1.0 pound/day on stover alone vs. 1.6 pounds/day on stover+turnips in the first cycle of a two to three cycle study). If these results hold through the remaining cycles of the project, they would indicate that overseeding annual forages resulted in an increased land-use-efficiency in terms of beef production per unit area.

Reported in 1998

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Annual Results

SARE #95-19

Development of a Farm-Wide System for Control of Many of the Principal Lepidopterous Pests of Grapes and Tree Fruits Based on Disruption of Premating Pheromone Communication Between Male and Female Moths

Location:
Commercial Peach and Grape Farms in the San Joaquin Valley, California

Funding Period:
July 1995 -

Grant Award:
$120,770

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Cooperators:
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Kent Daane, Specialist, Biological Control, UC Berkeley
Scott Johnson, Cooperative Extension Pomology Specialist, UC Davis
Peter Christensen, Cooperative Extension Viticulture specialist, UC
Harry Andris, UC Farm Advisor, Fresno County

Objectives

1. Establish laboratory colonies for each of the Lepidoptera species to be tested.
2. Determine for each species the critical concentration of pheromone components needed to effectively disrupt premating communication of the following major lepidopterous pests of California stone fruit and grapes: oriental fruitmoth (OFM), peach twigborer (PTB), omnivorous leafroller (OLR), raisin moth (RM), oblique-banded leafroller (OBLR) and orange tortrix (OT).
3. Perform quantitative analysis of the various pheromone components, both alone and in mixtures to determine chemical stabilities in the absence of air and volatilities when exposed to air.
4. Determine for each species the degree to which their specific pheromone components, presented separately or in mixtures, either enhance or interfere with the efficacy of communication disruption of other species when they are simultaneously exposed to marginally disruptive levels of their own pheromone components.
5. Demonstrate that appropriate combinations of the pheromone components representing each of the lepidopterous pests present in specified 160-acre blocks of grapes or stone fruit can be released together into the air from widely separated mechanical dispensers spaced on quarter-mile grids, providing effective communication disruption of each of the pests.
6. Determine and demonstrate the efficacy of this ranch-wide communication disruption system, maintained in 160-acre blocks through the entire effective pest season, by comparing reductions in larval infestations attacking the crop foliage, fruit and stems with reductions caused in comparison blocks by presently available commercial pheromone-disruption systems or by presently recommended pesticidal control methods.
7. Measure the edge effect of larval infestation of the respective pests that is caused by female moths that mate in nearby untreated areas and then fly into and lay eggs in the pheromone-protected areas.
8. Arrange field days at the 160-acre treated ranches and publish results in newsletters and appropriate agricultural publications to inform interested growers, farm advisors, PCAs and regulatory personnel at both state and federal levels with regard to the new technology.

Abstract

A novel device for dispensing pheromones into the air of agricultural fields, for the purpose of communication disruption and elimination of mating of pest moth species, is the puffer. These machines release repeated puffs of pheromone from pressurized aerosol cans, with individual puffs often containing pheromone equivalent to millions of female moths. They have a number of advantages, in comparison to traditional hand-applied pheromone-release devices. Because the pheromone is protected from light and oxygen until the moment of release, chemical breakdown is minimized. Two or more pheromones can be mixed and emitted together, giving the opportunity to obtain simultaneous control of more than one species. The amount of pheromone released is the same for the last puff as it was for the first puff released from a can, giving a predictable amount of pheromone delivered per unit of time. Labor costs for installing puffers are apt to be considerably lower than they are for hand-applied devices. Five large-acreage, season-long trials were conducted during 1996 and 1997 to evaluate the puffer technique for management of lepidopterous pests on peaches and table grapes. Two trials on peaches were directed at simultaneous mating disruption and control of the oriental fruitmoth, the omnivorous leafroller and the peach twigborer. Three trials on table grapes were directed at mating disruption of the omnivorous leafroller and raisin moth. In these trials, puffers showed high potential for controlling multiple pest species on a wide area, farm-wide basis.

Each of the Lepidoptera species is now reared in our laboratory on a bean-based artificial medium, except RM, which is reared on a bran-based medium. For each species, the sexes are separated while pupae, and virgin female moths are maintained in cages until they are used as bait in monitoring traps for determining the efficacy of synthetic pheromone treatments in interfering with orientation of male moths to females.

Our work to date has been directed toward determining optimum pheromone blends and quantities that are needed in order to disrupt premating pheromone communication of OLR, OFM and PTB in peaches and OLR, OT and RM in grapes. OFM blend is commercially available and consists of three components in a predetermined ratio. RM pheromone consists of 1 component.

OFM pheromone provides some disruption of communication between males and females of OLR; on the other hand, OLR pheromone has no effect in disrupting OFM communication. A large amount of cross disruption of communication is encountered among the three leafroller species, OLR, OT and OBLR, reflecting certain pheromone components that are identical in the pheromone blends of each of these species. This cross disruption of leafroller species stimulates our further investigation of possible generic pheromone blends that can effectively and simultaneously disrupt the communication of multiple species in the leafroller complex. No evidence for a lessening of communication disruption in any of the target species through simultaneous exposure to the pheromones of other species has been detected.

We regularly sample for larval damage to the fruit in transects, with sampling rows extending in both directions from border through center of field to opposite border. Through this technique, we have estimated that penetration of OLR mated females into puffer-protected vineyards is mainly for a distance of only about 20 m. However, our failure to obtain mating disruption for OLR in a 40-acre block and for RM in a 160-acre block indicates that under some conditions, which are not yet elucidated, moths of these species may penetrate into orchards or vineyards for greater, not-yet determined distances.

We have been interviewed 12 times during 1996 and 1997 by editors of farm magazines and newspapers. The stories have raised the interest of growers in the potential for the use of puffers in disruption moth communication. We have participated in eight different grower-oriented conferences during 1996 and 1997, with a combined audience of about 500 growers, PCAs and regulatory personnel. In November, 1996 and November, 1997, we attended a workshop of 40 research workers, growers and PCAs to explain the work to date with puffers and Ecogen coils.

Economic Analysis

Ultimately, puffers will probably be less expensive than other means for disseminating pheromones in orchards and vineyards. Individual puffers cost less than $30 and last for at least five years. Because puffers can be used at great separations in the field the cost of placement is low. One man can outfit a 40-acre block with 40 puffers in about two hours. An advantage of the use of puffers derives for the fact that multiple pheromone components can be combined in a single can, allowing simultaneous disruption of more than one pest species. The major expense will be the cost of pheromone chemicals, which are still mainly produced by specialty chemical companies

Potential Contributions

With the work only in the second year of a three-year project, impacts are not yet firmly established. Comments are made below where appropriate. Because Lepidoptera often represent the key pests of a crop, the ability to withhold hard insecticide applications has obvious benefits. Fewer pesticide treatments enable the establishment of biological controls, free the grower from the pesticide treadmill, with associated benefits of reducing likelihood of insect resurgences and pesticide resistance. We estimate that the implementation of pheromone-communication-disruption programs on peaches and grapes could result in elimination of 2 to 3 applications of hard pesticides per acre per year on these crops.

Farmer Adoption

Although no pheromones have been registered to date for use in puffers, commercial adoption of the method is imminent. A large farming company in the San Joaquin Valley, CA (Paramount Farming Company) is presently collaborating with this SARE project, assessing the opportunity to market puffers for mating disruption of a wide number of Lepidoptera species, on a variety of perennial and annual crops. The entry of such commercial interest into this puffer-based mating disruption for pest control will help to spur grower interest in the method.

Another year of research and commercial registrations and/or experimental use permits will be needed before operational recommendations can be made.

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Annual Results

SARE #95-21

Brassica Green Manure Systems for Weed, Nematode and Disease Control in Potatoes

Location:
Washington and Idaho

Funding Period:
July 1995 -

Grant Award:
$112,580

Project Investigator:
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Klaren Koompin, American Falls, Idaho
Carol A. Miles, Area Extension Agent, Chehalis, Washington

(Continued)

Objectives

1. Determine the efficacy of Brassica green manure systems for disease, nematode and weed control in potatoes.
2. Determine the nitrogen contributions from Brassica green manures.
3. Conduct an economic analysis of Brassica green manure systems compared to costs of current pest and nitrogen management practices.
4. Demonstrate the Brassica green manure system to potato growers, fieldmen and county agents through use of on-farm trials, seminars, workshops, extension publications and a video.

Abstract

Alternative pest control practices are needed to convert potato production from a high-input, synthetic chemical based system to a lower input system. Brassica green manures have shown potential for providing biological control of several common potato pests, including soil borne diseases, nematodes and weeds. Brassica species contain glucosinolates, sulfur containing compounds that are enzymatically hydrolyzed to toxic compounds when plant cells are disrupted. The second year of a three-year, multidisciplinary study to evaluate pest control in a Brassica green manure-potato system was completed. Three pest management systems were compared in a split plot design at three locations, Aberdeen, Idaho, Prosser, Washington, and Mt. Vernon, Washington. Main plots were low, medium or high pest control input levels, and subplots were green manure treatments: no green manure, winter rape (Brassica napus) or white mustard (Brassica hirta).

Incorporating winter rape sometimes reduced early or mid-season populations of certain weed species, but species response was location dependent. For example, populations of hairy nightshade and green foxtail tended to be reduced at Aberdeen, while common lambsquarters densities were reduced at Prosser and common chickweed populations were reduced at Mt. Vernon.

Weed control with winter rape incorporation alone was not commercially acceptable at any location. Incorporating white mustard generally was less effective for weed control than incorporating winter rape.

At all three locations, weed control with the combination of an incorporated green manure plus a low rate, postemergence application of rimsulfuron + metribuzin was similar to the high input, standard practice herbicide treatment. Soil borne disease control with the green manure system also was evaluated. At Aberdeen, the winter rape and white mustard green manure treatments had a higher percentage of Rhizoctonia canker-free stems than the no cover crop control. Columbia root knot nematode populations in the soil and tuber infection by nematodes were reduced by incorporating a winter rape green manure but were not reduced by incorporating white mustard residues. U.S. No. 1 yields were not affected by pest management input level at Prosser or Mt. Vernon, but medium and high input treatments had higher U.S. No. 1 yields than the low input treatment at Aberdeen. Lower yields in the low input treatment were primarily due to inadequate weed control. There were no effects of green manure treatments on total yield of U.S. No. 1 tubers at any location, but a size shift to larger tubers within the U.S. No. 1 grade was observed with the winter rape treatment at Aberdeen.

At Aberdeen, 40 farmers and agricultural industry personnel toured the green manure study in June, and about 20 extension agents and farmers toured the plots in August. Several presentations and workshops on green manure systems for pest and erosion control in potatoes were given in Idaho and Washington to audiences totaling about 550 growers, fieldmen, extension personnel and potato scientists. In addition, Idaho results will be presented at the Weed Management Workshop of the Idaho Potato Conference in January of 1998.

Site Information

Aberdeen, Idaho, is a high desert, sprinkler-irrigated potato growing area. The soil type is a Declo sandy loam with pH 8.1 and 1.5% organic matter. Prosser, Washington, is an arid northern desert with sprinkler-irrigated potato production. The soil type is a Hezel sand with pH 7.3 and 0.88% organic matter. Mt. Vernon, Washington, has a maritime climate and potatoes are grown under natural rainfall. The soil type is a Sedro Woolley silt loam with pH 6.8 and 2.36% organic matter.

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Ron Reimann, T&R Farms, Pasco, Washington
Reed Searle, Shelley, Idaho
Rob Thornton, Agri-Northwest, Inc., Tri Cities, Washinton

Potential Contributions

Positive benefits or impacts: The winter rape or white mustard green manure system provides excellent soil erosion control from 2 to 3 weeks after planting the green manure in August or September (depending on location) until potatoes are planted in April or May the following spring. Even after incorporation, the winter rape treatments still provide 25 to 35 percent cover from residue left on the soil surface. In addition, the green manure crop scavenges leached nitrogen and later releases it for use by the potato crop. The green manure system provides some early season weed suppression, but control is inadequate for using green manures alone as a weed management practice. However, the combination of green manure incorporation followed by a low-rate herbicide application provided good to excellent weed control. Using a green manure system also may have some benefits for control of some soil-borne potato diseases.

Farmer Adoption

Three growers in the Columbia Basin of Washington, Ron Reiman, Allen Olberding and Cody Easterday, have tried a white mustard green manure. Reiman reported excellent weed suppression, lower nematode populations early in the season and excellent ground cover with the white mustard green manure. He noted two potential drawbacks, increased wireworm populations and overwintering of green peach aphids if white mustard does not winter-kill.

Winter rape green manures have not been tested by Washington growers because of the concern that they are too weedy. In Idaho, on-farm tests will be needed as soon as a successful system has been identified in experiment station trials. Grower advisory committees are in place at each location (9 growers total). The growers review research results, give input on the project and help make decisions to improve the design of on-farm trials.

New Hypotheses

Nitrogen cycling data from this study suggest that under certain environmental conditions, N release by the incorporated green manure may be rapid. If rapid nitrogen release occurs during tuber initiation in potatoes, initiation may be delayed long enough to result in reduced yields in potato production areas with short growing seasons.

Reported in 1998

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Annual Results

SARE #95-24

Managing Soil Biota in Low-Input and Organic Farming Systems to Enhance Soil Fertility

Location:
Sacramento Valley

Funding Period:
July 1995 -

Grant Award:
$175,000

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Erica Lundquist, LAWR, UC Davis;
Rob Venette, Nematology, UC Davis

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Tom Kearney, Cooperative Extension, University of California
Karen Klonsky, Agricultural Economics, UC Davis
Tom Lanini, Botany, UC Davis
A. Van Bruggen, Plant Pathology, UC Davis
W. Horwath, LAWR, UC Davis
Gene Miyao, Cooperative Extension, University of California
Bruce Rominger, Farmer, Yolo County, California
C. Shennan, Vegetable Crops, UC Davis

(Continued)

Objectives

1. To measure long-term and seasonal changes in the light fraction pool of organic matter in four farming systems and relate these changes to microbial and soil fertility parameters.
2. To test the effect of carbon:nitrogen (C:N) ratio of organic matter inputs on microbial biomass and community diversity, the abundances and ratio of fungal- and bacterial-feeding nematodes, nitrogen mineralization, labile organic matter pools, and crop productivity.
3. To enhance the rate of cover crop decomposition by fall management practices that enhance nematode populations in spring.
4. To measure nitrogen loss due to denitrification as a function of farming system and C/N ratio.
5. To determine causes and impacts of seasonal fluctuations in microbial biomass.
6. To provide analyses of microbial and nematode community size and structure to collaborators.
7. In collaboration with colleagues involved with outreach activities associated with the SAFS project (funded by a training grant), to develop educational material about the importance of soil biology in sustainable agriculture and farming practices that enhance soil communities.

Abstract

This project's primary objectives are to compare soil biological communities in conventional, low input and organic farming systems and to explore means to maintain agricultural productivity and enhance sustainability by managing the soil communities. The study was carried out at the Sustainable Agriculture Farming Systems (SAFS) project at UC Davis comparing two- and four-year rotations (including tomatoes, safflower, corn, wheat/beans), managed using conventional, low input or organic practices. We measured phospholipid fatty acids (PLFA) fingerprints of microbial communities in tomato soils at SAFS throughout the season, following tillage and fertilization, at different spatial locations within the field, and within different farming systems. Microbial communities in the different farming systems could be clearly differentiated. Comparing the SAFS data to a larger data base of agricultural soil, the relative importance of environmental variables in governing the composition of microbial communities were ranked in the descending order of importance: soil type > time > specific farming operation (e.g., cover crop incorporation or sidedressing with mineral fertilizer) > management system > spatial variation in the field. California agricultural soils, particularly the surface layer, are subject to numerous extreme wet/dry cycles within the growing season. Microcosm studies of the effect of wet/dry cycles on soil communities indicated large differences in microbial communities in the surface and deeper layers of soil. Adaptation to wet/dry cycles by surface, but not deeper soil, microbial populations was evident within several months of exposure to wet/cycles. Surface soil populations had lower concentrations of lipids associated with stress and did not change in composition as much as did deeper soil populations.

To evaluate whether managing soil biotic populations could enhance soil fertility, field plots were set up at the SAFS companion plots, where we added either straw, straw plus summer cover crop, straw plus fall irrigation, or straw plus winter cover crop. Nematode and microbial communities were measured, as well as soil nitrogen and yields of the following tomato crop. Generally, the ratio of bacterial:fungal-feeding nematodes was greater relative to the other treatments only when the soil was irrigated in the fall. Dry soil in the fall selected for fungal-feeding nematodes. Fall irrigation only and fall irrigation plus a late summer cover crop and/or straw application provided significantly greater available N and higher tomato yields the following spring than did treatments without fall irrigation or a late summer cover crop. Carbon inputs without irrigation had no effect on nitrogen or crop yields. We concluded that managing the soil in the late summer and early fall, when soil temperatures are conducive to biological activity, influenced the bacterial-grazing nematode community in the spring with potential benefits for the tomato crop.

A large number of publications and presentations have resulted from this work.

Ed Sills, Farmer, Yolo County, California
Donald Stewart, Agronomy and Range Science, UC Davis
Steven R. Temple, Agronomy and Range Science, UC Davis

Site Information

The research plots are located on 28 acres of the Agronomy Farm at UC Davis. The experiment is conducted on Reiff/Yolo Silt Loam, a medium to heavy soil. The climate is Mediterranean with average summer day temperatures of 90_F, rainfall mostly between December and March averaging 25 inches annually. The plots are 60 by 220 feet (1/3 acre), to allow for use of large-scale farm machinery for all operations, including planting, discing and harvesting.

Economic Analysis

Our ultimate goal is to improve out understanding of the complex interactions between the availability of plant nutrients and the soil food web, specifically the microbial community and their nematode predators. As part of the larger USDA SARE funded project, "A Comparison of Conventional, Low Input and Organic Farming Systems: The Transition Phase and Long Term Viability," findings of our project have implications for the larger project. Management of the fertility of the organic farming system is one of the project's major challenges. Our results suggest that a relatively low cost management practice in the fall, irrigation, can lead to a 15 percent increase in available nitrogen from the cover crop. This increased efficiency may reduce the need for expensive supplemental fertilizers (e.g., foliar sprays).

Potential Contributions

One potential contribution is the finding that management practices increase N availability from fall cover crops by approximately 15 percent. If adopted, such practices would diminish reliance on mineral fertilizers in the low input system, reduce the need for supplemental forms of fertilizers in the organic system, and may result in reduced leaching of N due to immobilization during the fall and winter in cover crop and soil biota biomass.

Farmer Adoption and Direct Impact

A significant impact of our studies has been changes in management of the winter cover crop in the SAFS main plot low-input and organic management systems. Previous approaches were to leave the soil bare and dry during the fall and to sow the winter cover crop in November, to be germinated by winter rains. More recent approaches involve planting the cover crop by mid-September and germinating it through irrigation, consistent with the results of our fall management project. This information has been shared with farmers and extension specialists at the numerous workshops in which we have been involved. Fall management of cover crops conceivably would diminish reliance on mineral fertilizers and may result in reduced leaching of N due to immobilization during the fall and winter in cover crop and soil biota biomass. Another impact of our project is that our presentations and workshops at numerous outreach activities have promoted a dialogue with, and generated feedback from, growers about how to measure and the importance of soil biology in agriculture. At this point, as our knowledge base is rapidly increasing, it is important that we stay in close communication with the potential users of this information.

New Hypotheses

These studies are leading us into consideration of the importance of microarthropods in the food web as a tool for regulated release of N from pools in the bacterial-grazer community. Preliminary models have been developed and field sampling is underway. We have also recognized the potential importance of fungal-feeding nematodes in soils maintained under drier conditions. PLFA analysis corroborate the high relative abundance of fungi in dry fallow soils in the fall. This will be explored in future studies.

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Annual Results

SARE #95-25

Influence of Alternative Vegetable Systems on Beneficial Arthropods and Soil Biology Dynamics and Soil Quality Trajectory

Location:
Oregon

Funding Period:
July 1995 –

Grant Award:
$180,000

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Farmers:
Mike and Mark Dickman, Silverton, Oregon
Keith Grover, Salem, Oregon
Carl and Nancy Hendricks, Scio, Oregon
Peter and Tina Kenagy, Albany, Oregon
Ron and Larry Pearmine, Gervais, Oregon
Dale Lucht, Molalla, Oregon
Roger Hamlin, Corvallis, Oregon

Objectives

1. To identify and explore sensitive early indicators of changes in soil quality useful to agroecosystem analysis and farm management.
2. To identify and explore linkages between changes in vegetation/soil management and associated C inputs with soil community structure and processes and above ground arthropods dynamics.
3. To test and adopt strategies for conducting participatory research and education programs.

Abstract

This is the second year of a three-year project being conducted on soil quality and sustainable crop management. Seven farmers are participating. During this second year, all participating farmers put in field treatments by splitting a field into two treatments (minimum till/cover cropping vs. clean till/winter fallow). There are two long-term crop rotation/cover crop experiments also being studied. All these are intensive irrigated vegetable systems.

Preliminary results indicate certain biological (enzyme assays) and physical measurements (aggregate stability) are early (within 1 year of change in soil management) soil quality indicators and that cover crops are effective in improving soil quality. Both microbial structural and functional diversity are affected by winter cover crops. In addition, cover crop residues increased the substrate utilization potential of microbial communities, suggesting that communities of cover-cropped soils are more metabolically active than communities from fallow soils. Four farms that had high densities of soil predators at plowdown also had a successful cover crop. A predacious aboveground ground beetle (P. algidus) was found (during cropping season) on cover cropped soils but not on winter fallow soils. These results are promising, as cover crops appear to be way to encourage both below and above ground beneficial insects that could control crop insect pests. A Soil Quality Scorecard was developed in collaboration with 24 farmers which is a subjective assessment of soils that can be done on-site without lab analyses.

This is the second year of a three-year project being conducted on soil quality and sustainable crop management. The first cropping season was devoted to finalizing the on-farm research sites and working with growers on developing on-farm treatments and getting baseline data. During this second year, all participating farmers put in field treatments by splitting a field into two treatments (minimum till/cover cropping vs. clean till/winter fallow). There are two long-term crop rotation/cover crop experiments being studied as well. All study sites are under intensive irrigated vegetable systems, typical of the Willamette Valley.

This year we completed an Oregon soil scorecard. In collaboration with NRCS we developed a protocol for adapting a scorecard on a regional basis as pilot project. This is an important expansion of our original Oregon SARE Project that provides the opportunity for this project to have national implications. From our Oregon project, NRCS will be adapting the scorecard across the U.S.

At all sites the winter cover crop appears to be producing more stable aggregates immediately prior to spring seedbed preparation. This effect is diminished primarily by tillage during planting and somewhat by crop growth, but at some sites the water stable aggregates at harvest still seem to be greater with the cover crop treatment than with the fallow. The cover crop treatment appears to cause a shift from aggregates smaller than one millimeter to aggregates larger than one millimeter compared to the fallow.

These results are encouraging in that certain microbial and physical properties are sensitive to changes after only one year of a change in management. This gives hope for the potential use of soil quality indicators guiding farmers to manage soil for long-term sustainability. In turn, this could lead to higher, more stable crop yields.

All sites were characterized for bacteria, fungi, and nematodes. These data are being analyzed but a preliminary conclusion is that soil type is a major factor in determining microbial numbers. There is evidence of an increase in fungal populations based on fatty acid analysis of soil communities. The proportions of many other fatty acids were significantly affected as well, indicating that other populations of the microbial community are changing in response to cover crops.

Our study of the long-term impacts of tillage and vegetation management on above ground arthropods has focused on the four taxonomic groups, spiders (Araneae), harvestmen (Opillones: Phalangiidae), ground beetles (Coleoptera: Carabidae), and rove beetles (Coleoptera: Staphylinidae). These groups are predators, rich in species, sensitive to soil management, and have inherent value in the agricultural ecosystem.The most abundant ground beetle at eight of ten sites is the European species, Pterostichus melanarius. P. algidus is commonly found in Oregon forest habitats. P. algidus was present in the cover crop system and absent in the clean-tilled system at the OSU Vegetable Farm. P. algidus may be responding to the presence of a winter cover crop and spring tillage refuges, and may be an indicator of changes in the cropping system.

Each taxa was dominated by a few species. Many other species occurred in low numbers. No generalizations could be made about the response of the larger taxa to the presence of cover crops or tillage refuges. Each species responded in a unique manner to habitat choices and the level of disturbance in the cropping systems.

This year we developed, in collaboration with 24 farmers, a Willamette Valley Soil Scorecard. This will be completed early in 1998. This has been another opportunity to integrate scientist and farmer knowledge in assessing soil quality and development of soil management practices that promote soil quality.

Potential Contributions

We expect to quantify the benefits of cover crop systems on soil quality. Identification of sensitive soil quality indicators holds potential to assist farmers in determining which management practices are improving their soils. Development of the Soil Scorecard will enable distribution of this approach for assessing soil quality by NRCS through out Oregon during the coming year.

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Annual Results

SARE #96-03

Evaluation of a Perennial Vegetable, Asparagus, as a New Commercial Crop for Hawaiian Farmers

Location:
Hawaii

Funding Period:
July 1995 -

Grant Award:
$49,595

Project Investigator:
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Cooperators:
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Scott Walker, Jersey Asparagus Farms, Inc., Pittsgrove, New Jersey
Steve Fukufa, County Extension Agent, University of Hawaii, Wahiawa, Hawaii

Objectives

To determine the feasibility of introducing asparagus as a new commercial crop in Hawaii

Abstract

During the summer of 1996, the field was plowed and prepared. A drip irrigation system was installed with drip lines spaced at 5-ft intervals along all the plot lines. Polyethylene mulch was laid over the drip lines to control weeks. A Venturi system was installed at the head of the irrigation line to regulate fertilizer and salt applications in the irrigation water. Soil nutrient analysis was done and it was found that potassium levels were very low (140 ppm) as were calcium (1480 ppm) and possibly sulfur. This was expected following sugarcane, which depletes the soil of these nutrients. The soil was checked for nematodes and found to have very low counts of plant parasitic nematodes as expected following sugarcane.

Seeds of eight varieties of asparagus were planted in seedling flats in August 1996 and germinated in a greenhouse owned by Hawaii Agriculture Research Center at Maunawili, Hawaii. There were three New Jersey asparagus varieties: Jersey General, Jersey Gem and Jersey Giant and five California varieties: Apollo, Atlas, Grande, Purple Passion and UC 157 F1. After about 10 weeks' growth in flats, the seedlings were taken to the trial field site for transplanting.

Fertilizer was applied through the irrigation system on a regular schedule as nitrogen: phosphorus:potassium (NPK) 15-15-15. A total of 170 lb N was applied in this way to all plots and fertilization was stopped on March 11, 1997. At that time, an additional 80 lb N per acre was applied as solid urea by hand to the high-nutrient treatment plots. The total fertilizer applied was 170 lb N per acre to the low rate plots and 250 lb N per acre to the high rate plots. Both also received 81 lb phosphorus per acre during August 1997 through the irrigation system to make up for deficiencies in these nutrients before the first harvest begins. At harvest, scheduled to begin in November 1997, we will start the brackish water treatments by applying 1200 ppm salt through the irrigation system.

Weed control has so far not been a problem and no herbicides have been applied. When the seedlings were small, the mulch kept the weeds from over growing the plots. As the asparagus grew, the resulting foliage shaded out most weed growth. On the north side of Oahu, a rust disease outbreak occurred in asparagus plantings. Our trial was not infected. The dryer, open area and general prevalence of trade winds probably was helpful in preventing this fungal disease which usually develops with humid conditions and wet foliage. It is also possible that fungal spore inoculum did not arrive in the Waialua area. In May, an outbreak of Cercospora fungus disease occurred in our project. Most of the older fern leaves had numerous lesions. Dithane fungicide (DF at 2 lb/acre) was sprayed over the plots four times at weekly intervals beginning on May 20. The older leaves suffered some dieback from the disease, but plant growth was otherwise so vigorous that it does not appear that the harvest will be affected. No further disease has developed since that time.

Since July 1997 the asparagus ferns made vigorous growth. No disease or pest problems occurred and, once the ferns closed in, weeds were not a problem either. Ferns were to be cut back on December 8, 1997 and the first harvest was to begin on December 15, with harvesting continuing every other day for two to three weeks. Data on weights of spears harvested in each size range on each date for each variety and treatment will be recorded. A field day is scheduled to take place during the harvest period. The media, extension agents, Hawaiian farmers and other interested persons will be informed of the event. The project has generated significant interest among local growers and some have already visited the site.

Site Description

The site selected for the project was a half-acre field in Waialua, Hawaii, on the island of Oahu. This is a section of the farm leased by the cooperating farmer, Milton Agader. The area had previously been planted in sugarcane for a number of years

Information Dissemination

The Oahu extension agent has visited the project site and tells us that he has had inquiries from many Oahu farmers about the project. The plots were recently relabeled with higher stakes and colored tags with the variety names. Large wooden signs were placed at the site identifying the project and the main irrigation treatments. The cooperating farmer has also had numerous inquiries from other small farmers in the area who have stopped by to observe the asparagus crop. An open house day is planned for later this summer.

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Annual Results

SARE #96-07

Reducing Environmental Contamination from Feedlot Manure in the South Platte River Basin through Agronomic, Economic and Social Analysis and Education

Location:
Colorado

Funding Period:
July 1996 -

Grant Award:
$206,000

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Tim Stanton, Animal Science
Bill Brown, Phil Westra, Dawn Wyse-Pester, Plant Pathology and Weed Sciences
Dana Hoag, Agriculture and Resource Economics
Michael Lacy, Erich Stroheim, Sociology
Ron Meyer, Extension Education
Frank Peairs, Entomology
Jim Self, Soil, Water and Plant Testing Lab

Cooperators:
Ted Buderus, Grower, Greeley
David Bossie, George Breniman, Brian Wells, Weld Laboratories, Greeley
Mark Crookston, Northern Colorado Water Conservancy District. Loveland
Tom Haren, Colorado Cattle Feeders, Denver

(Continued)

Objectives

1. Determine optimum feedlot manure application rates and accompanying nitrogen (N) fertilizer needs for silage corn and to use the pre-sidedress soil nitrate test and the chlorophyll meter as a guide for in-season N recommendations in manured fields.
2. Determine crop water use and nitrate loss below the root zone as a function of manure application rate and timing.
3. To evaluate the effect of manure rates on soil quality and microbial populations and on pest populations (weeds, diseases, insects) and management recommendations.
4. Compute the costs and returns to alternative management schemes, determine economic returns and constraints for hauling and understand the decision-making processes and relationships of persons and organizations in the chain from feedlot stocks of manure to potential users of manure as a fertilizer.

Educational Objectives

1. Change the perception of manure as a waste to its being viewed as a valuable resource and to increase the use of manure credits so that applications will be made at agronomic rates and environmental problems minimized.
2. Encourage feedlot operators to conduct manure testing and to give the nutrient analysis of each load to the recipient.
3. Train manure haulers/spreaders in calibration of their equipment and proper application techniques.
4. Teach consultants, fertilizer dealers and producers to base fertilizer recommendations on soil testing, manure analysis and calibration, the pre-sidedress soil nitrate test and chlorophyll meter measurements.

Abstract

Concentrated animal feeding operations are an integral component of western agricultural systems, yet environmental issues may constrain their long-term sustainability. This project's goals are to improve our understanding of the agronomic, economic and sociological aspects of manure management to help animal and crop producers optimize the use of manure, increase its value as a soil amendment and protect the environment. Two corn fields with different soils and management histories are being used to study the effect of different amounts of manure on crop growth, pest problems, soil quality and economics of crop production and manure handling. Education programs, workshops, demonstrations and fact sheets, are aimed at optimizing management methods, increasing the value of manure and fitting manure into crop production systems.

In the first year of the project we found some yield increases from manure on the field that had few manure applications in the past. Soil and plant nitrogen contents increased with increased manure applications, suggesting we may be able to use them to predict sidedress nitrogen requirements. Pest populations (weeds and insects) varied between the fields but we did not find any differences among manure rates. Soil quality factors (microbial activity and earthworms) also varied between the fields. Differences between the fields may be due to the different manure histories or to differences in soils or other management factors. Interviews with growers identified a number of issues, such as nitrogen availability, weeds and transportation costs, that need to be quantified before manure can be accepted by more farmers.

Presentations on composting as a means of increasing manure value were made to four workshops: Healthy Plains Initiative, Home on the Front Range, Alamosa County Commissioners and Colorado Horse Council. Visits have also been made to horse, sheep and dairy producers who asked for information

about composting. A workshop with 30 managers and technicians from 20 western soil test labs covered methodology of manure analysis and how to make nitrogen fertilizer recommendations from them.

Steve and Judy Kelly, Manure Haulers, Greeley
Jim Park, Grower, Greeley
Robert Reynolds, Monfort Feedlots, Inc., Greeley
Marvin Shaffer, USDA-ARS, Fort Collins
Dan Webster, Webster Feed Lots, Greeley

Site Information

Northeastern Colorado produces more corn and cattle than any other area of Colorado. About 800,000 acres are in corn production and the numerous cattle feedlots make it one of most animal-dense areas in the country. Other important crops include wheat, sunflowers, hay and a variety of vegetables. Soil types vary considerably, ranging from sandy to clayey. Rainfall in the eastern plains is low relative to crop requirements, so irrigation water from alluvial aquifers and snow melt from the Rocky Mountains is critical.

Potential Contributions

Because the project is still in its first year we cannot yet quantify the benefits from it. We expect that the outcomes will be better optimization of manure applications to plant needs, which should reduce the chances of nitrate leaching into groundwater supplies and perhaps higher plant yields. Improving manure handling and increasing the perception of it as a high-quality plant food may increase the use of manure, in terms of both numbers of farmers and in distance from manure sources.

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Annual Results

SARE #96-12

A Comparison of Conventional, Low Input or Organic Farming Systems: Soil Biology, Soil Chemistry, Soil Physics, Energy Utilization, Economics and Risk

Location:
Sacramento Valley, California

Funding Period:
July 1996 -

Grant Award:
$200,000

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Willi Horwath, Soil Fertility and Plant Nutrition
Carol Shennan, Soil Fertility and Plant Nutrition
Tom Lanini, Weed Management
Jeff Mitchell, Water Relations

Staff:
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Kelly Brewer, Information Specialist
Sean Clark, Research Manager

Cooperators:
Scientists:
Leisa Huyck, Water Relations, California State University at Humboldt
Bruce Jaffee, Nematology, UC Davis

(Continued)

Objectives

1. Compare four farming systems, with differing levels of dependence on external resources over a twelve-year period, with respect to:
   a. Abundance and diversity of weed, pathogen, arthropod and nematode populations.
   b. Changes in soil biology, physics, chemistry and water relations.
   c. Crop growth, yield and quality as influenced by different pest management, agronomic and rotational schemes.
   d. Economic viability.
2. Evaluate existing and/or novel sustainable and organic farming tactics.
3. Distribute and facilitate adoption of information generated by this project to all interested parties as it becomes available.

Abstract

The Sustainable Agriculture Farming Systems (SAFS) Project was established to study the transition from conventional to low-input and organic practices. Treatments include three four-year rotations under conventional (conv-4), low-input and organic management and a conventionally-managed, two-year rotation (conv-2). Crop yields in all systems have been near or above Yolo County averages thoughout the study. Nitrogen (N) availability and weed competition have been the most important factors limiting yields in the organic and low-input systems. In the conventional systems soil structural problems may be limiting yields. Positive effects on soil resulting from low-input and organic management include increased soil organic matter, increased pools of P and K, higher microbial biomass and activity and increased water infiltration rates and water-holding capacity. All of the farming systems have used pesticides to some degree, but pesticide use in the low-input and organic cropping systems is 0 to 50 percent of that used in the conventional systems.

The four SAFS treatments include four-year rotations under conventional (conv-4), low-input and organic management and a conventionally-managed, two-year rotation (conv-2). All three, four-year rotations include processing tomato, safflower, bean and corn. In the conv-4 treatment, beans are double-cropped with winter wheat, while in the low-input and organic treatments, beans follow a mixture of oats, vetch and pea. Cover crops are grown during the winter preceding all other cash crops in the low-input and organic systems. The conv-2 treatment is a tomato and wheat rotation. There are four replications of each treatment and all possible crop rotation entry points are represented within each farming system replicate, resulting in total of 56 plots. The plots measure 68 m by 18 m (0.12 ha) each and are arranged in a randomized block, split-plot design.

The most profitable farming system continues to be the conv-2 system due to the greater frequency of tomato in that rotation. Among the four-year rotations, the organic system with price premiums is most profitable while the organic system without premiums is least profitable. The low-input corn system, which uses about 50 percent fewer pesticide and fertilizer inputs, has emerged as an agronomically superior and economically viable alternative to conventional production. New research efforts are focusing on developing reduced-tillage tomato production methods, nonchemical and low-chemical weed control tactics and cover crop management strategies to optimize N availability to the following cash crop. In addition, research is underway to quantify the contribution of cover crop N to the following cash crop in the low-input and organic systems and measure the impact of farming system management on soil biota and the associated effects on soil fertility and pest management. Information generated from SAFS research has been disseminated through a new video, workshops, annual field days, field tours, educational

materials, peer-reviewed articles and a World Wide Web homepage. Interest in the findings of the SAFS project by farmers, industry, researchers and the general public is clearly increasing.

Site Information

The SAFS project was established in 1988 at the Agronomy Farm of the University of California at Davis to study the sustainability of conventional, low-input and organic farming systems in the Sacramento Valley. The soil at the 8.1-ha site is classified as Reiff loam and Yolo silt loam. The region has a Mediterranean climate with most rainfall occurring during the winter months (December - March) and relatively little during the growing season. Furrow irrigation is used for most crop production. Total annual rainfall is typically 400-500 mm and daytime temperatures average 30 to 35° C during the growing season.

Economic Analysis

In general, the relative costs, gross returns and net returns among the systems were similar to previous years. However, reduced costs and good yields lead to greater profits in all systems in 1997. Most notably, tomato production costs in the low-input system were substantially reduced by substituting one herbicide application for hand hoeing, leading to greater profits.

Total costs for the four farming systems in 1997 ranged from $734 to $806 per acre. The conv-4 system had the lowest costs at $734 per acre. It was followed by low-input system at $739, the conv-2 system at $775 and the organic system at $806 per acre. The cost of planting corn in the three four-year rotations increased this year because of crow damage that required replanting. The amount of acreage replanted varied from 25 percent in the low-input system to 150 percent in the conv-4 corn system. This drove up the costs of all three systems. Other major sources of cost variation among treatments were the incorporation of the oat/vetch/pea crop in the organic system instead of harvesting it as hay as was done in the low-input system, weed control practices, fertility management and yield differences in beans.

Potential Contributions

SAFS project research has demonstrated many of the benefits and limitations of low-input and organic farming systems in California's Sacramento Valley. The findings with the most potential for positive benefits lie in the areas of pest management, N fertility and nutrition and soil structural improvement.

Agronomic and economic evaluations of pest management systems have shown dramatically different potentials for pesticide reduction in the processing tomato and field corn. The findings illustrate that pesticide reductions in tomato, while possible, are economically costly primarily because of the lack of efficient nonchemical weed management tactics. Although pesticide use could be reduced by 50 percent, premium prices are needed to compensate growers for increased pest management costs that may average 50 percent more than conventional pest management costs. By contrast, pesticide use in corn, bean and safflower grown in a four-year rotation could be reduced by 50 percent or more with little or no reduction in yield.

Farmer Adoption and Direct Impact

The SAFS project receives increased attention each year from farmers, industry, researchers and the general public. Ideas that were once considered to be impractical or even radical are now gaining in popularity. As consumer demand for organic foods increases more growers are considering the transition to organic farming systems and seek out the SAFS project to get information and advice. Others are simply interested in reducing costs or improving soil quality. Information and experience generated by the SAFS project since 1989 can be incredibly valuable in informing growers of some of the agronomic, economic and ecological consequences of their many options.

Reported in 1998

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Annual Results

SARE #96-13

Implementation and Assessment of Economic and Environmental Impact of a Weather Monitoring/Pest and Disease Risk Assessment Network in Commercial Pear Production in Oregon

Location:
Oregon

Funding Period:
July 1996 -

Grant Award:
$58,290

Project Investigator:
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Objectives

1. Evaluate the affect of site specific, real-time disease forecasting on annual grower net income and pesticide use on an area-wide basis.
2. Demonstrate to growers and consultants state-of-the-art weather instrumentation and information systems for use as pest and disease management decision-making aids.
3. Develop educational materials and conduct educational programs to train approximately 300 growers and consultants in the application of new pest emergence and disease forecasting technology.

Abstract

Tree fruit growers must be knowledgeable in an extended range of disciplines including entomology, plant pathology, meteorology, labor management, business management, as well as horticulture. The time that must be devoted to a particular practice can affect whether or not it is used. Grower acceptance of new information systems requires that the information must be current, reliable, and readily accessible.

Pear scab is a fungal disease of economic importance to fruit growers around the world. Under the proper conditions, significant disease infection risk can develop in pear orchards within hours. To avoid significant economic losses, growers must either protect their crop(s) with protective fungicide sprays applied before infection conditions, or rapidly respond (within 72 hours of the start of infection) to infection conditions with a spray to eradicate or control the disease. The cost of protectant fungicide programs can be significantly more than eradicant programs. Depending on weather conditions, less fungicide applications may be made during a growing season using a scab eradication strategy. Temperature and moisture are the key environmental conditions affecting disease infection. Computer models have been developed to use current weather conditions to make up-to-date disease infection predictions.

There are several barriers to widespread utilization of disease infection risk models. Region-specific evaluations of disease prediction models are needed before these models receive widespread acceptance. Weather information gathering by a grower can be a time consuming practice. Due to locally different climatic conditions, disease risk in one orchard may be significantly different from a nearby orchard.

The goal of this research project was to provide growers with current, reliable, readily accessible, and locally validated disease risk information 24 hours a day, and to educate them in the use of these data in disease (specifically pear scab) control decisions. This year (1997) was the first year of a three-year project.

A real-time weather system was purchased and established in the Hood River Valley, a major pear-growing region in northern Oregon. This system collected weather data (temperature, relative humidity, leaf wetness, and precipitation) from a network of remote weather stations established in small plots in commercial pear orchards around the district. Trees in these blocks were not treated with fungicides, and were monitored weekly from May through mid-July for pear scab symptoms. Development of pear scab lesions on leaves and fruit of the untreated trees were used to evaluate the accuracy of a disease risk model, which used weather data from the same orchard site.

The model accurately predicted two scab infection periods, one in April and one in late May. Several other "false positive" reports of scab infection periods produced by the model did not coincide with the development of new leaf and/or fruit scab lesions. These false infection periods occurred during the summer months. Low levels of disease spores and/or increasing tissue resistance to infection as the season progresses explain these false positive reports.

In the 1998 season, the first full season of work on this project, model evaluation work will continue as well as initiation of large-scale field work and grower education. New grower cooperators will be included in the study, and some of those worked with in 1997 will not be in the project in 1998. These changes will be made based on lack of significant scab pressure in at least one of the four commercial orchards in the 1997 field work.

We will continue to work with Adcon Telemetry, Inc., the weather system manufacturers/software developers, to improve the pear scab model for commercial release. Field validation of other pest models will also be attempted.

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SARE #96-16

Tillage Practices for Improving Nitrogen Cycling and Soil Quality

Location:
Central Coast, California

Annual Award:
$102,000

Funding Period:
July 1996 -

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Objectives

1. Describe soil C and N dynamics immediately after tillage.
2. Examine the effect of OM additions on C and N dynamics after tillage. Identify management options that minimize short-term C and N loss by altering the type, timing or frequency of tillage, both during crop production and during the winter fallow.
3. Analyze the costs and benefits of the new management practices in terms of economic feasibility and agroecosystem health.
4. Demonstrate these tillage options in the context of commercial agricultural practices to show their practical applicability to growers.

Abstract

Reduced tillage techniques and organic matter additions to the soil can restore SOM and add to the long-term sustainability of agricultural soils. Increases in C availability, as a result of these practices, directly impact soil N dynamics, which in turn affect the amount of NO_3-N that can be lost in irrigation and rainfall events. The mechanisms of tillage-induced loss of C and N are not presently understood.

The Salinas Valley of California is a center for intensive year-round vegetable production. The mild climate and the extensive use of irrigation and fertilizers allow growers to produce two or three vegetable crops per year. Large NO_3-N leaching and denitrification losses occur in these cropping systems, and NO_3-N levels exceed the public health standard (10 mg N L^{-1}) in nearly half of the wells in the upper aquifer. Very little organic matter is returned to the soil after harvest of these vegetables. Tillage occurs frequently, ranging from single passes with cultivators for weed control, to ripping, disking and leveling a field between crops.

The objectives of this project (see above) are to develop a better understanding of short-term responses of soil to tillage and determine if adoption of reduced tillage methods is useful and viable in these intensively managed systems. Due to the fact that funding arrival was very late, we are just beginning the project at this time. Two projects are underway. One project is on-farm comparison of two types of reduced tillage that both retain semi-permanent beds: one type just tills the beds at depths of 0-15 and the other deep rips the beds to deep layers of the profile. Slight differences in inorganic N and bulk density have occurred after six months of comparison. A larger project is designed to examine the effects of increased organic inputs and reduced vs. conventional tillage practices on soil microbial ecology and crop N uptake and growth, plant pathogens, insect pests, soil physical properties and economic costs. Our intention is to choose a farm site for this project this winter so that sampling can begin in the spring.

On-farm comparison of two types of reduced tillage. This project has been underway for two years with matching funding from the Iceberg Lettuce Advisory Board. Two strip plots are being compared: 1) the 'Sundance-System' performs tillage operations that till the surface layer of the beds, whereas a 'deep' minimum tillage set of operations tills the beds to nearly 75 cm depth. After six months of both treatments, some slight differences have appeared. In the 'Sundance' treatment, inorganic N was higher in the surface layer than in the 'deep' minimum tillage treatment, but bulk density had increased at lower depths in the 'Sundance' treatment compared to the 'deep' minimum tillage treatment. Differences in compaction and microbial activity will continue to be tested in the future.

On-farm comparison of reduced and conventional tillage, with and without high inputs of organic matter. A large group project involving a plant-soil ecologist, irrigations and soils farm advisor, plant pathologist and entomologist is planned to begin this winter. Reduced tillage will utilize a 'Sundance-System' that minimizes the number of tillage passes and retains semi-permanent beds with conventional tillage that

entails disking and reshaping beds between each crop. High inputs of organic matter will be achieved by planting winter cover crops and adding manure and compost. We have designed a randomized complete block design with four treatments: +organic matter, reduced tillage, +organic matter, conventional tillage, -organic matter, reduced tillage, -organic matter, conventional tillage. At least one crop of iceberg lettuce will be grown each year. Sampling of inorganic N, nitrate leaching, microbial biomass and activity, disease, insect pests and bulk density will be conducted periodically through the next three years, along with economic analysis of management practices. We are in the process of choosing a collaborator for the project who is willing to continue it for three years.

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SARE #96-21

Controlled Grazing on Foothill Rangelands

Location:
Northern California

Funding Period:
July 1996 –

Grant Award:
$40,750

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Dan Suther, Veterinarian, Redding, California
George Work, Rancher, San Miguel, California
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Objectives

1. Demonstrate controlled grazing on foothill range/annual grassland and irrigated pasture.
2. Demonstrate monitoring procedures to assess range condition and trend and livestock performance.
3. Teach research-based controlled grazing practices to livestock producers.
4. Compare effects of controlled grazing to conventional grazing on livestock production and economic performance.
5. Compare effects of controlled grazing to conventional grazing and livestock exclusion on plant communities.
6. Determine the effects of controlled grazing on trace mineral nutrition of cattle.
7. Determine the effects of controlled grazing on parasitism in cattle.

Abstract

We developed 22 rangeland paddocks using over six miles of two-wire electric fences. We laid nearly two miles of water line serving three storage tanks and five permanent watering points. We designed and built a fencing layout on the irrigated pasture that enables us to create as many temporary paddocks as we need for strip grazing. This past year we used up to 40 paddocks on the irrigated pasture. Fencing used includes 12 1/2 gauge high tensile fencing, temporary portable electric fencing and spider temporary fencing. We also designed and installed five high tensile electric cattle guards. The irrigated pasture is watered using a quick-connect type watering system with portable troughs. Water delivery devices installed include a ram pump, a portable windmill, a pasture pump and a solar pump.

In June 1996 we stocked the project with 27 bred cows culled from the field station herd. They were due to calve in October and November. They were a commercial cow herd of mixed breeding. Cows were weighed and body condition scored monthly. One cow did not calve, and one died during parturition, resulting in a herd of 26 cows and 25 calves on January 1, 1997.

A major part of this project is eliminating the need for hay by shifting the herd from fall to spring calving. This way the cows will have a much lower requirement through late fall and winter when feed resources are lowest in quality and quantity. However, these first-year cows were in heavy lactation during this period, so their condition dropped dramatically. Cows gained condition back as forage quantity and quality improved in the spring. However, northern California endured a severe spring drought in 1997. In response to the drought we culled several animals. By mid-May our herd consisted of 13 cows with calves and three additional heifer calves weaned and retained from cows we culled.

We weaned the calves from the cows and turned the cows in with the bulls on June 24. We took the bull calves out of the project and retained all ten of our heifer calves for replacements. Heifers were grazed on irrigated pasture and the cow herd grazed dry range. We used a 45-day breeding season. Cows and heifer calves were reunited at the end of the breeding season to minimize the number of paddocks per herd.

We collected and tested forage samples monthly. We established 22 permanent rangeland transects and eight permanent transects in the irrigated pasture in 1996 and 1997 to measure species composition and cover. We had established 18 permanent photo points in December 1995. Photographs are taken each year at each of these sites.

Palpation of cows on December 9, 1997, confirmed that all 13 cows were pregnant and due to calve in April.

Site Information

The project site is a 250-acre watershed consisting of approximately 230 acres of rangeland and 20 acres of hillside irrigated pasture in the Sierra Foothills of northern California. Annual precipitation is approximately 30 inches. Site elevation varies from approximately 800 to 1400 feet. A seasonal creek, fed by several springs within the site, flows through the project area.

The site consists of 22 rangeland paddocks and a variable number of paddocks on irrigated pasture. The site has working corrals including a scale and squeeze chute. A total of three water storage tanks and six water troughs have been developed. In addition a portable watering system has been installed in the irrigated pasture. This system also serves three of the rangeland paddocks.

Economic Analysis

We price the cattle we cull and calves we transfer back to the field station herd as if they had been sales, checking current market to show income on the project. We add gross income to estimated changes in inventory value to calculate gross product (the gross value of production). Direct costs (feed, health costs, transportation costs, etc.) will be deducted to calculate gross margin when the project year is completed.

Potential Contributions

Controlled grazing may be a way to carry more animals on a ranch sustainable. With increasing lease costs and competition for grazing land, this may provide an important and sustainable competitive advantage for ranchers. Controlled grazing may also control weeds without chemicals and improve water quality without expensive capital improvements or destocking the range. If spring calving is successful it will reduce or even eliminate the need to feed hay in beef cattle enterprises.

We encourage the development of at least 12 paddocks per group of animals. We advocate adjusting pasture rest periods as plant growth rates change, using the shortest grazing periods possible (consistent with the required rest), using high stock densities and matching the stocking rate with the carrying capacity. We recommend using "herd effect" to rejuvenate range with moribund plants or capped soils. We recommend matching the livestock enterprise (species, age, and size of animal, and the season of use) to the environment supporting production. We encourage the use of low stress livestock handling techniques and of electric fences for livestock control in many situations. Perhaps most important, we recommend crunching the numbers to determine the economic and financial consequences of management decisions.

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SARE #96-27

The Production of New, Existing and Native Crops under Conventional and Organic Production Practices in Costilla, Garcia and Taos Pueblo

Location:
Southern Colorado and Northern New Mexico

Funding Period:
July 1996 -

Grant Award:
$100,000

Project Investigator:
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New Mexico Department of Agriculture
New Mexico State University Cooperative Extension Service
Rio Costilla Cooperative Livestock Association
Sangre de Cristo Growers Association
New Mexico Organic Commodities Commission
Questa Producers Association

Cooperators:
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Del Jimenez, Rural Agricultural Improvement and Public Affairs Project, NMSU CES
Terri Badhand, Taos County Economic Development Corporation

(Continued)

Objectives

Demonstrate the production of new, existing and native crops under conventional and organic/low input production practices in Costilla (New Mexico), Garcia (Colorado) and Taos Pueblo and perform an economic analysis on the above.

Abstract

Project personnel sought funds to maintain and increase the momentum gained in a 1995 project funded by the New Mexico Department of Agriculture (NMDA) to continue to develop localized sustainable agriculture in northern New Mexico and southern Colorado and at Taos Pueblo.

The project sought to increase the acreage planted to crops and continue to plant demonstration plots of new and innovative crops. The project also sought to develop a small greenhouse operation in Costilla, New Mexico, and to continue to develop a wild plum and chokecherry project at Taos Pueblo.

To date, much has been accomplished. Grain acreage grew from 150 acres planted in Costilla and Garcia in 1995 to over 300 acres planted in 1997 in these villages as well as at Taos Pueblo. Additional farmers from one other community in the region (Questa, New Mexico) were also brought into the program this year. Demonstration plots of cool season vegetables and a wide variety of flowers were planted at Costilla, Questa, Taos and at Taos Pueblo. The transplants for this project were produced in the greenhouse facility in Costilla.

One other important project result was that chokecherries and wild plums (two Native American traditional foods) were processed commercially for the first time at Taos Pueblo and marketed in northern New Mexico.

Site Information

The setting for this project is Taos County in northern New Mexico and Costilla county in southern Colorado and includes the villages of Costilla, New Mexico; Garcia, Colorado; Questa, New Mexico; and Taos Pueblo. These villages have some of the highest unemployment rates in the two states and a high poverty rate. Employment opportunities are limited to seasonal work at local ski resorts or other low paying jobs.

Residents do have land and water resources and limited equipment. Farm sizes range from 1 to 40 acres, with the average land holding being about 10 acres per farmer. Soil types range from extremely stony soils to rich, deep loams.

Climate is a major factor to the region; the growing season can be as short as 80 days. Water supplies for irrigation can be highly variable, ranging from nothing one year to a surplus the next.

The infrastructure necessary to practice irrigated agriculture has deteriorated through lack of maintenance on many farms.

In addition to these problems, there seems to be an entire generation of farmers who did not work the land. Most of the residents who farmed these lands before WWII left the area to seek employment in major cities such as Albuquerque or Denver. Their children, now grown and mostly in their mid to late 40s, are the clientele for this project. They have a desire and commitment to staying in their communities but often lack the hands-on farming experience.

In spite of these limitations, there is a strong sense of community in each village, a willingness to cooperate with one another within communities and between communities and a strong commitment to remaining on the land. Alternatives to farming are few. In most cases, it is either farm or leave.

To date, this project has exceeded all expectations. The project has been expanded to include farmers in Questa, New Mexico, and to develop a small greenhouse project in Costilla. In 1997, over 30 farmers participated in the crop planting project (primarily wheat), demonstration plots of high value specialty crops (primarily cool season varieties) were planted in Costilla, Questa, Taos and at Taos Pueblo and 9 people worked in the greenhouse demonstration project, producing transplants for use by local residents and for sale at the Santa Fe and Taos farmers= markets.

An additional project, not an initial focus of this particular SARE project, was the development of a community garden at the Taos County Economic Development Corporation's headquarters. The garden enabled several young women on welfare or in the Women, Infants and Children program to plant, produce and market vegetables from approximately one acre and earn some supplemental income.

The primary focus of the project has been on expanding the crop base to the region and developing and teaching sustainable agricultural practices. Wheat acreage was expanded from 160 acres planted in 1995 to over 400 acres. All growers became organically certified in August 1997, after undergoing the New Mexico organic certification process. Certification in itself ensures continued use and development of organic agricultural practices such as developing and maintaining soil fertility and practicing crop rotation. By certifying, growers committed themselves to this program.

An important development for the project occurred when a certified organic flour mill was located in central New Mexico, and a high end Santa Fe area bakery committed to buying all wheat produced from the project and to developing a completely new product line. In addition, chokecherries and wild plums were harvested at Taos Pueblo, processed commercially for the first time and marketed in northern New Mexico.

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Harold Anderson, Anderson Grain Storage
Jose and Kathryn Cordova, Valencia Flour Mill
Willem Malten, Cloud Cliff Bakery
Bernie Torres, Torres Transportation

Economic Analysis

It is difficult at this time to analyze the results from this project regarding the financial costs, returns and risks of adopting sustainable farming practices and systems. On one hand, the costs associated with not adopting sustainable practices in these communities (or not embracing agriculture as a viable option to gain income at all) are extremely high in the social sense, i.e., villagers would most likely have to leave their farms and communities.

The simplest measure is purely financial. Growers participating in this project earned an estimated $23,200 from farming in 1997. The greenhouse project generated an additional $3,000. This income is limited; however, it is the first income seen by almost an entirely new generation of farmers. Furthermore, the lessons learned this past year will lead to definite improvement next year and in the years to come.

In a social sense and within the context of sustainability, this project has had the immeasurable impact of keeping families on farms, within their communities. It is has seen individuals coming together to work as a team during planting and harvest, in a cooperative spirit.

In addition, many of these farms have brought in income for the first time in a generation, and did so in an environmentally friendly fashion, without the use of chemicals such as pesticides and herbicides..

Farmer Adoption and Direct Impact

This project has had direct and positive impacts on over 30 farmers and their families. An additional 9 people participated in the greenhouse project. It has enabled many who had no alternative in 1996 but to seek income outside agriculture an income from agriculture in 1997. It has also positively benefited young women on welfare, an organically certified flourmill, one large bakery in Santa Fe and the SARE program itself.

Farmers have been involved in the planning of this project since 1993, the time of our first meeting. The most important development in this project has been that agriculture as a livelihood has been reintroduced to northern New Mexico and southern Colorado, a fundamental change in practice.

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Annual Results

SARE #96-29

Potential of a Corn/Annual Medic Intercropping System for Weed Control, Reduced Soil Erosion and Improved Forage Production

Location:
Wyoming

Funding Period:
July 1996 -

Grant Award:
$95,100

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Charles Jones, Jones Farm,
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Jack Cecil, UW Research and
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Torrington, Wyoming

Objectives

1. Evaluation of the most appropriate pasture legume species for effective weed suppression when undersown in irrigated corn.
2. Determine the appropriate seeding rate and sowing time of the selected annual medic to maximize weed suppression.
3. Investigate the regenerative capabilities of the selected annual medic and its potential to compete with weeds in a continuous-corn cropping system.
4. Establish the potential for improving livestock production from grazing the corn stubble/legume pasture mix in autumn following corn harvest.

Abstract

Farmers in the Northern Great Plains have shown an interest in inter-cropping farming systems. Advantages of an inter-cropping farming system, which contains a legume species, includes reduced soil erosion, weed suppression, improved soil fertility and improved forage quality. Many of the farmers in southeastern Wyoming graze corn stalks and are looking at ways to improve the forage quality of these corn stalks. However, no information is available on inter-cropping annual medics with corn in the Northern Great Plains.

During the first year of this SARE-funded project the objective was to evaluate for the most appropriate pasture legume species for effective weed suppression when undersown in irrigated corn. To accomplish this experiments were conducted at three Wyoming sites (in Huntley, Lingle and Torrington). Two of the sites were under sprinkler irrigation; the other was under furrow irrigation. Plots were 3.05 m. by 6.10 m. with four replications in a RCB, split plot design. Eight legume species were evaluated in corn under both a weed-free and weedy situation.

In addition, there was a weed and medic free check and a weedy, medic free check. Corn yields were reduced by the presence of medics in some treatments; others were comparable to the check yields. Medicago lupulina reduced corn yields by 4 percent whereas Medicago truncatula reduced corn yields by 17 percent. Corn yields were reduced approximately 62 percent by the presence of weeds regardless of medic species. The medics did not significantly suppress weed growth.

From these studies it is concluded that medic/corn companion cropping system may be viable. However, for this system to succeed it will require a medic species that is not very competitive with corn so corn yields are not significantly reduced. Medics alone were not able to suppress weeds adequately. Management systems that exploit the competitive abilities of medic in combination with other weed control measures are required. Black medic appears to have the greatest potential for this farming system in the Northern Great Plains. During the second year the second and third objectives of the SARE funded project will be addressed. Studies are planned that will exploit the competitive abilities of medic focusing on seeding rate and sowing time using high and low herbicide input systems to help with the control of weeds while maintaining medic and corn production. Medic's regeneration potential will be monitored at year one study sites. If these species cannot regenerate it will most likely be cost prohibitive to use this farming approach.

A field tour was held on August 2, 1997, at TREC, with 70 persons in attendance. A poster paper was presented at the Western Society of Weed Science meetings in Portland, Oregon, in March. A second poster presentation was made at the AAAS meetings in Corvallis, Oregon, in June.

New Hypotheses

Management systems that exploit the competitive abilities of medic in combination with other weed control measures are required.

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Annual Results

SARE #96-32

Identification of Management Practices and Cultivars for Organic Hard Winter Wheat Production

Location:
Utah

Funding Period:
July 1996 -

Grant Award:
$93,911

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Objectives

1. Identify existing hard winter cultivars that perform best in yield, test weight, competitive ability and disease and insect resistance or tolerance under organic conditions.
2. Determine effectiveness and value of compost amendments and green manure in increasing yield and grain quality.
3. Determine the rate of mineralization and estimate number of years of benefit provided by compost addition.
4. Analyze the economic breakeven points through enterprise budgeting for organic production with and without compost addition.
5. Determine end use quality of current cultivars and elite lines by mixograph, NIR and miller and baker evaluation.

Abstract

Dairy manure compost was applied to dryland organic wheat production fields in Box Elder county, Utah. The production field is in crop-fallow rotation,7 so two sites (alternate years) were treated in the first two years. The compost was applied at 0 (control) and 112 Mg ha^{-1} (50 ton $acre^{-1}$) in a split-plot arrangement with compost addition as whole plots with three reps and ten germplasm entries as split plots within the whole plots. The two years of data were combined in a single analysis that was a split-split plot design. Years and locations were confounded due to the nature of the crop-fallow rotation. Additionally, compost treatments of 0, 22.4, 56 and 168 Mg ha^{-1} were examined as a randomized complete block design for the single cultivar Hansel (with 0 and 112 Mg ha^{-1} compost addition data for Hansel coming from the immediately adjacent split-plot experiment). Yield trials and soil testing in the year since the project began have shown that compost addition results in higher grain yields for winter wheat. The yield effect is not the same for all cultivars, and there is a significant genotype by environment interaction. The highest yielding wheat cultivar under no compost addition to date is Bonneville, a high quality bread wheat released within the past three years by the University of Idaho. At a compost application rate of 112 Mg ha^{-1}, the top yielding cultivar to date is a breeding line, UT1650-150, that has recently been released as a cultivar with the name Utah-100. Protein levels in the grain also increased as a result of the compost addition. The linear correlation for protein level was 0.73. Improvements in mixograph quality were also observed.

Compost has been effective at increasing grain yield in the initial year of this study. Additional years of data will need to be accumulated to determine if this is a reliable conclusion. In addition, data have been collected only for the crop year immediately following compost addition. Future years of experiments will examine the continuing effect of the initial compost addition. There has been a highly significant ($Pr>F=0.0001$) effect of cultivar and compost addition rate, and the cultivar compost rate interaction was also highly significant. The finding that the cultivars and breeding lines differed in yield potential was not unexpected, the entries were selected as a fairly divergent population.

Under dryland conditions, the relative height of the wheat plants is one indicator of general health and production capability. While the cultivars differed in height to begin with, dramatic differences in height were observed due to compost treatment. As would be expected the genotype * compost interaction was also highly significant. In fact, height is a less variable trait to measure than yield as was evidenced by much lower CV associated with the height analysis (5% vs. 11% for yield).

Grain quality has also been improved through the addition of compost in the first year of study. Mixographs have been run on the two sets of data and show increases in mix time dough strength and dough tolerance due to compost addition. This is also observed in NIR protein determinations. The

average protein level of all of the cultivars under the control conditions was 13.6 percent while the average protein level with addition of 112 Mg ha^{-1} of compost was 14.1 percent.

We plan to determine end use quality of current cultivars and elite lines by mixograph, NIR and miller and baker evaluation. Samples of wheat from the organic experiments have been provided to millers. We have not received feedback from them yet. We continue to work with other millers to determine high quality mixograph types. The first year mixograph results do show improvements in dough rheological properties with addition of compost.

Potential Contributions

Reduction of chemical fertilizer applications can save producers large amounts of money. However, organic production can only continue so long as it is profitable. Currently, thousands of acres of dryland organic wheat are being grown in Utah. Since this project began, one of our producer collaborators has changed their rotation to take advantage of an emerging market for organic safflower. We are adapting to their change in practice by changing our experimental design to take advantage of new potential information about a crop that was not in our original study as well as continuing to gain valuable new data on wheat. The change that we are implementing in our experimental design is made possible, in part, to emerging GPS/GIS technologies that will allow us to "tag" areas of the field for our compost additions. The farmer can work the field and plant their new wheat-safflower-fallow rotation using their normal production equipment instead of our specialized research plot equipment. This will allow us to take yield and quality samples from within the plots as well soil samples over the long term without disrupting the normal cultural practices of the grower.

New Hypotheses

Originally, we expected to observe yield and quality improvements from additions of 112 Mg ha^{-1}. Our first year data indicated a larger effect at lower rates than we had anticipated. As a result we have changed our emphasis to lower rates of application. The goal is to make application as economical as possible while still retaining yield and quality benefits.

Producer Involvement

There have been no field days or conferences specific to this research since it is still in early stages. However, the research has been mentioned at extension field days (two in 1997 with average attendance of 70), and we have met with individual growers six times in 1997 as well as answering about four email requests about the research.

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Annual Results

ACE #94-03

Compatibility of Livestock and Water Birds on Improved Pastures

Location:
Nevada and California

Funding Period:
July 1994 -

Grant Award:
$33,333

Project Contact:
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Cooperators:
Althea and Daniel J. Brimm, Jr
California Fish & Game
Ducks Unlimited
U.S. Fish & Wildlife Service
California Waterfowl Association
Don Dow and Jay Dow, Jr.

Objectives

1. Evaluate effects of timing and intensity of beef cattle grazing on waterfowl and shorebird use of irrigated pasture.
2. Develop demonstration irrigated pasture units for use in educational activities sand pilot research studies.

Abstract

Since over 70 percent of the wetlands remaining in the continental U.S. are on private lands, it is important that we increase our understanding of how these vital resources can be managed to meet wetlands, water bird and wildlife habitat functional needs and to meet the economic needs of the land owner. Irrigated pastures have been developed adjacent to wetlands habitat at the Jay Dow, Sr. Wetlands to evaluate the impacts of different timing and intensities of cattle grazing on water fowl and shore bird use of the pastures for foraging, nesting and other functions. A complete economic assessment is planned.

A comprehensive review paper on this subject has been published in 1997 by the project team, which emphasizes the lack of good research data on this subject. Two years of data on shore bird, water bird, and other wildlife use of the site as native pasture were completed in 1996, prior to irrigated pasture development. Water has been delivered to the site, the irrigation system is operational, and the pastures were established in the fall of 1997.

Anecdotal evidence and preliminary data at other cooperator wetlands/pasture sites suggest that cows with calves are the preferred graziers of irrigated pastures adjacent to wetlands. Coyote nest predation is a major problem at many western Great Basin wetlands sites, and cows with young calves will not tolerate coyotes in the pasture, thus significantly reducing nest predation.

In the 1996 field season, the third year of preliminary data was gathered at the site for proposed pasture development at Jay Dow, Sr., Wetlands (JDW). The purpose of this research is to assess the extent and nature of bird use of the area before modification. From 2 April through 11 June 1996, the area of oldfield was censused weekly using standard point count methodology. Ten-minute point counts were conducted in each of eleven 10-acre plots. During each count, individuals were identified to species and aged and sexed where possible. The positions were mapped for all birds seen or heard. The following table lists the bird species recorded during 1996 censuses and indicates relative occurrence and whether or not breeding activity was noted (X). Breeding activity consisted of territorial, nesting, or prospecting behavior. Non-breeding activity included foraging and loafing. Occurrence was common (C) if the species was encountered on nearly all census dates, sporadic (S) if seen during approximately half of the censuses, and (R) rare if seen only once or twice.

Mallard (Anas platyrhynchos), X, S
Northern Pintail (Anas acuta) X, S
Northern Shoveler (Anas clypeata) X, S
Gadwall (Anas strepera) X, S
Northern Harrier (Circus cyaneus) X, C
American Kestrel (Falco sparverius) R
Peregrine Falcon (Falco peregrinus) R
Willet (Catoptrophorus semipalmatus) X, C
Long-billed Curlew (Numenius americanus) X, C
Mourning Dove (Zenaida macroura) S
Short-eared Owl (Asio flammeus) X, S

Common Nighthawk (Chordeiles minor), X, S
Horned Lark (Eremophila alpestris) X, C
Common Raven (Corvus corax) C
European Starling (Sturnus vulgaris) S
BrewerÆs Sparrow (Spizella breweri) S
Savanna Sparrow (Passerculus sandwichensis) X, C
Western Meadowlark (Strunells neglecta) X, C
Yellow-headed Blackbird (Xanthocephalus xanthocephalus) S
BrewerÆs Blackbird (Euphagus cyanocephalus) S
Brown-headed Cowbird (Molothrus ater) X, S

Other species not on the 1997 list that have used the study area for breeding purposes in past years include Blue-winged Teal (Anas discors), Black-necked Stilt (Himantopus mexicanus), American Avocet (Recurvirostra americana), and Killdeer (Charadrius vociferus). Each of these species was present at JDW this year but was not observed on the proposed pasture site.

Based on observed depredation of nests located during censuses, early termination of breeding or nesting-associated behavior of most breeding individuals, and few sightings of juvenile birds, reproductive success of birds on the study site was low. Although the State of California and local ranchers practice predator control on land that borders JDW, coyotes were responsible for a substantial amount of nest loss in 1996. As part of a study of Killdeer breeding biology at JDW, real eggs were replaced with wooden replicas. This was done to insure that adult birds would continue to tend nests, allowing chicks to be returned to parents after real eggs were hatched in incubators. Incredibly, coyotes found and consumed over 200 of these wooden eggs. At least one resident coyote regularly hunted the pasture area in 1996. Ravens are another common source of nest loss on the wetlands.

Pronghorn (Antilocapra americana) is another species for which the pasture are appeared to serve important functions. Antelope were often seen foraging on the study site. Several females calved there and sheltered young calves in shrubby areas.

A major review paper on the subject by Lorelei Powers and Hudson A. Glimp was published in 1997. An extension publication, published jointly by Hudson Glimp of UNR and Allen Rasmussen of Utah State, is planned for 1998.

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Annual Results

ACE #95-103

Orchard Alley Cropping in the Subhumid Topics

Location:
Hawaii

Funding Period:
July 1995-

Grant Award:
$30,430

Project Investigator:
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Steve Skipper, NRCS District Conservationist, Kealakekua, Hawaii

Advisory Panel:
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Katie Friday, USDA Forest Service, Honolulu, Hawaii
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Joe Kennedy, Farmer, Island of Molokai, Kualapuu, Hawaii
Hans Kersting, Farmer, Island of Kauai, Kapaa, Hawaii

(Continued)

Objectives

1. Establish contour hedgerows in an approximately 1.5 acre tropical fruit orchard in the subhumid tropics.
2. Measure hedgerow prunings fresh weight and nutrient concentrations for two NFT species at each cutting, in order to ascertain fertilizer replacement values.
3. Measure soil nutrient levels on an annual basis and crop growth on a semi-annual basis for each of six treatments and a control.
4. Measure fluctuation of soil levels on an annual basis.
5. Demonstrate the orchard alley cropping system, and present two workshops for farmers, ranchers, extension agents and agricultural consultants.
6. Determine economic costs and returns of orchard alley cropping.

Abstract

This project, located on a farm in Holualoa, Hawaii, studies alley cropping with fruit tree crops in the subhumid tropics. In alley cropping, fast-growing, nitrogen-fixing trees are grown together with crops to provide an abundant source of organic matter that is applied to the soil around the crops. By cycling nutrients in the agricultural system, alley cropping in an orchard setting holds promise for greatly reducing, and possibly eliminating, the need for manufactured or imported fertilizer inputs, replacing them with an on-site organic source of fertility.

Research focuses primarily on the ability of the alley cropping technique to provide sufficient nutrients to tree crops, as well as the economic feasibility of the practice for orchards.

The hedgerows were coppiced three times in 1997. Hedgerow prunings' fresh weight and nutrient concentrations for the two NFT species were measured at each cutting in order to ascertain fertilizer replacement values. Data to date shows that the hedgerows produced over 10 tons of mulch per acre in 1997. Nutrients from the on-site mulch source provided the nutrient equivalent to over 500 pounds of chemical fertilizer per acre per year, potentially replacing 400 lb. urea, 25 lb. treble super phosphate and 120 lb. muriate of potash. The mulch also reduced the need for weed control around the crop trees. While final soil data and crop measurements are still being analyzed, the health and vigor of the mulched crop trees visibly surpasses that of unmulched trees. The costs of this practice are roughly equivalent to using purchased organic fertilizers for the nutrients. This practice may be particularly of benefit to cash-poor Pacific Island farmers.

Since the beginning of this project in August 1995, three workshops for farmers have been held at the site, as well as four field days, with a total of over 140 people having visited the project. One field day with participants from the Hawaiian Homelands, displaced sugarcane workers, and other farmers was held in 1997. Twelve farmers are known to have integrated nitrogen-fixing trees in their farms as a result of their participation in a workshop or field day.

In addition to the workshops, since the beginning of this project in August 1995, three workshops for farmers have been held at the site, as well as four field days, with a total of over 140 people having been given an up-close tour of the project. Participants have included farmers and extension agents from the Islands of Hawaii, Maui, Molokai, Oahu and Kauai. In addition, the practice has been shared in slide presentation for the Hawaii Tropical Fruit Growers Association. An advisory committee consisting of farmers involved in sustainable and organic farming from throughout Hawaii was given detailed progress reports in 1997.

A farmer guide to orchard alley cropping will be produced and made available to practitioners free of charge. Results of this project will also be submitted in article form to local farmer-oriented journals and newsletters, as well as international publications dedicated to farmers and trainers in sustainable tropical agriculture.

Mark Kimball, Farmer,
Island of Hawaii,
Holualoa, Hawaii
Lee Kunitake, Farm Services
Agency, Hilo, Hawaii
Lee Lopez, Farmer,
Island of Maui,
Haiku, Maui, Hawaii
Liz Nakabayashi, Farmer,
Island of Hawaii,
Honokaa, Hawaii

Potential Contributions

Adoption of the orchard alley cropping practice holds great potential to reduce farmer dependence on purchased chemical fertilizers, reduce environmental pollution from chemical fertilizers and weed control, reduce erosion and increase overall soil health, while allowing continued levels of fruit crop production.

This practice produced approximately 20,000 pounds of mulch per acre in one year. Cycling nutrients in the agricultural system mimics the production of organic matter in tropical forests and improves soil life and crop health. The nutrients from the on-site mulch source provided the equivalent to over 500 pounds of chemical fertilizer per acre per year, equivalent to 400 lb. urea, 25 lb. treble super phosphate, and 120 lb. muriate of potash.

Benefits of this system to the farmer include an abundant on-site source of nutrient-rich organic material for use as mulch and slow-acting fertilizer; soil building through accumulation of organic matter through mulch; erosion control; reduced weed control labor; other products for the farm such supplementary fodder and fuel and an opportunity to replace expensive fertilizer imports with an on-farm source obtainable with labor.

Potential environmental benefits of this practice include the elimination of soluble fertilizers, reducing soil and water contamination; soil conservation through the creation of erosion barriers; reduction of pollution from transportation of chemical and/or organic fertilizers, particularly to the remote Pacific Islands and potential reduction of herbicides through mulch weed control.

Producer Adoption

As a result of participating in a workshop of field day and discussions with the farmer/manager of this project, we know of twelve farmers who have incorporated nitrogen-fixing trees into their farms to provide an on-site source of mulch and organic matter. Of these twelve, one was a farmer who had sloping land set up an alley-cropping system like the one described in this project. He coppiced his hedgerows for the first time in November 1997. The use of nitrogen fixing trees is becoming better known and more accepted, and a farmer on the Hawaiian Homelands is now using these trees to restore fertility on his land, after attending a field day.

Once established the hedgerows do not require maintenance except during cutting for mulch, and in fact the area of the farm that needs mowing and other standard maintenance is reduced by the presence of hedgerows. Maintenance around the mulched fruit trees is also greatly reduced, as weeds are suppressed by the mulch. Not having to purchase fertilizers has reduced the cash output necessary to operate the farm, although the labor costs to prune hedgerows and apply the mulch may make the overall expense about even.

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Annual Results

ACE-#96-04

Weed Suppression and Enhancement of Wildlife and Beneficial Insect Habitat in Center-Pivot-Irrigated Field Corners

Location:
Columbia Basin, Washington

Funding Period:
July 1996 -

Grant Award:
$61,485

Project Investigator:
Robert Gillespie
Ag Systems Scientist/Educator

Objectives

1. Develop managed plant communities to increase animal and plant diversity and reintroduce native plant species into the uncultivated corners of center-pivot-irrigated fields of the Columbia Basin.
2. Compare plant, insect and wildlife populations in managed plant communities to existing range and herbicide-cultivated corners and field borders to determine if plant and animal species differ in these areas.
3. Determine if managed plant communities reduce weed, insect pest populations, diseases and their vectors in adjacent crops.
4. Determine if managed plant communities increase bio-diversity in field corners when compared to existing plant communities.
5. Identify and promote the use of cover crops, especially following low residue crops such as potatoes, beans and peas, which have the potential to reduce soil erosion in fields adjacent to study sites.
6. Quantify fall and spring forage production of specific cover crops and assess their ability to suppress weeds and reduce soil erosion.
7. Conduct field research, demonstrations, local meetings, and prepare publications to inform growers of the environmental advantages, management feasibility, risks and profitability of perennial cover in uncultivated field corners and borders.

Abstract

This project began in April 1997 with the arrival of funding. Unfortunately, by that date we missed an opportunity to plant grass at our study sites—the uncultivated corners left by center-pivot-irrigated fields—in 1996 and had to wait until the autumn of 1997 for our first seeding. A desire to get grass seeded into a set of four such corners and the greater-than-average snowfall and extra moisture received in the winter of 1997 led us to think that we could successfully establish grass in these corners by planting it in late winter. We seeded four species of grass on March 21 into one-third of the area of each of four corners at study site 1 located adjacent to the Columbia Wildlife Refuge. After seeding we received very little moisture, and we attributed the poor growth and establishment of grass in these four corners to the very dry conditions and severe weed pressure by Russian thistle. This experience reaffirmed that a delayed fall dormant seeding is preferable to spring seeding of native grasses unless supplemental moisture can be provided in the spring. Due to poor grass establishment these areas were re-seeded this fall, on December 2, 1997, along with the second third of each corner. Presently, two-thirds of each corner is planted to four species of grass and one-third was left as an untreated check. The check area growth is composed of the existing plant community, mostly weeds. This experimental design will allow us to compare the plant and animal communities in the untreated check to those in the revegetated areas in each corner.

Four grass species were seeded at our second study site on Dec. 3, 1997. The two corners at site 2 were randomly selected for revegetation with native plants and the adjacent two corners were left in the original plant community to serve as untreated checks. The experimental design was modified at this study site because the four circle corners adjacent to this field are smaller in area than those at the first study site. We were concerned that placing an untreated check and a treatment (native replanting) adjacent to each other might result in an interaction between the plant and animal communities in the untreated check and the treatment.

A third study site was seeded to the same four species of grass in September 1996 with other funding. The four grass species at all three sites are bluebunch wheatgrass, Basin wildrye, Sherman big bluegrass and thickspike wheatgrass.

Last spring and summer we began characterizing the plant and insect communities at study sites 1 and 3 and at a native habitat adjacent to study site 1. The plant community in all 12 plots (3 per corner) at site 1 was characterized in mid-May and again the first week of July. The plant community in the four corners at this site was composed of pioneer species such as downy brome (cheatgrass), Russian thistle, 2 to 3 species of mustards, kochia, lambsquarter, prickly lettuce, fiddleneck, horseweed, and weedy grasses. Ninety percent of the canopy cover was composed of three weed species. Mustards composed 42 percent of the canopy cover while Russian thistle and downy brome (cheatgrass) made up 25 percent and 22 percent of the canopy cover, respectively. The four grass species seeded in mid-March made up no more than 1 percent of the canopy cover at the May sample date and were not detected in June.

The plant community in the shrub-steppe habitat adjacent to the above study site was composed of sagebrush (22%), bluebunch wheatgrass (7%), sandberg bluegrass (2%), balsamroot (2%), phlox (0.6%) and microbiotic crust (52%). Other native species making up less than 1 percent of the canopy included Mariposa lily, hairy plantain, cushion daisy and buckwheat. Pioneer species included downy brome (3%), Russian thistle (0.2%), mustard (0.2%) and prickly lettuce. Numbers in parentheses are percent canopy cover.

At site 3 our four grass species were seeded into three corners that were established when three furrow-irrigated fields were converted to a single center-pivot-irrigated field. Grass was planted in mid-September and irrigated once before the main ditches of the furrow irrigated fields were destroyed this spring. The plant community at this site is composed of the four seeded grass species, which included Sherman big bluegrass (11%), Basin wildrye (5%), thickspike wheatgrass (2%) and bluebunch wheatgrass (2%). Other plant species included; sandberg bluegrass (23%) at one corner near a remnant of native habitat, Russian thistle (< 1%), kochia (1%), Canada thistle (4%), Barnyard grass, horseweed, henbit, prostrate knotweed, tansy mustard (all < 1%). In disturbed shrub-steppe habitat located adjacent to this study site, the plant community is composed of rabbitbrush (36% transect 1 and 0% transect 2), sandberg bluegrass (18%), orange globe mallow and phlox (< 1%), crested wheatgrass (1.5%) and macrobiotic crust (42% and 18%, on transect 2 where canopy cover of downy brome was 51%). Pioneer species include downy brome (5% and 51%), chickweed (2%), kochia, prickly lettuce, horseweed, knapweed and meadow salisfy (< 1%).

Last summer we also characterized the plant community at a site MCC re-vegetated by the Washington State Fish and Wildlife Service. I selected two of the five plots for comparison. At one plot a re-vegetated area was destroyed by cultivation resulting in a plant community composed of kochia (55%), horseweed (35%), and mustards (2%) compared to thickspike wheatgrass (37%), Sherman big bluegrass (4%), Canada thistle (3%), and downy brome, prickly lettuce, horseweed, kochia, and lambsquarter (all < 1%).

Arthropod sampling was also conducted at these sites. We are in the process of comparing the fauna in the field corners to that of shrub-steppe habitat. Generally, the corners contained a greater number of arthropods than the shrub-steppe habitat but this may be due to the fact that arthropod sampling began after most of the forbs in the shrub-steppe habitat had finished flowering and were no longer host to phytophagous insects or their predators and parasitoids. Arthropod sampling was delayed until summer because it required a lot of time last spring to set up study plots, develop our plant identification skills, and characterize the plant communities at our study sites.

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Annual Results

ACE #96-09

Reduced Herbicide Use Through Improved Mechanical Cultivation and Banding of Herbicides

Location:
Arizona

Funding Period:
July 1997 -

Grant Award:
$121,000

Project Investigator:
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Stephen Husman, Cooperative Extension Service, UA

Cooperators:
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Lee Clark, Farm Manager
Robbie Waterhouse, Michael Brooks, Lee Smith, Marvin Wuertz, John Post, Farmers
Pegasus Machinery Co., Bingham Equipment Co.

Objectives

The goal of this project is to provide cotton growers in the southwestern United States with effective, commercially acceptable alternatives to extensive herbicide use for weed control. To achieve this goal, six objectives have been established:

1. Evaluate and demonstrate cultivator guidance technologies under Arizona field conditions.
2. Evaluate and demonstrate the potential for revitalizing old in-row and close-to-the-row cultivation technologies that were abandoned when herbicides were introduced.
3. Evaluate and demonstrate guidance systems in combination with herbicide banding.
4. Develop and evaluate at least one new cultivation system.
5. Compile operational and cost data on reduced herbicide vs. conventional weed control systems.
6. Disseminate information relative to the advantages of alternative weed control systems.

Abstract

The start of the project was delayed until late April because funds were not received from SARE until that time. As the funding came after most of Arizona's cotton had been planted, it was not possible to set up and conduct the field trials that had been proposed. Absence of field plots meant that it was impossible to work with the herbicide banding trials, to evaluate and compare weed control effectiveness of cultivator guidance systems and in-row mechanical weed control devices or to collect operational and cost data to facilitate comparison between reduced herbicide and conventional weed control practices. As a consequence, project activities were directed toward only two objectives: demonstration of precision guidance systems along with in-row and close-to-the-row mechanical weed control devices and development of a new, mechanical weed control methodology. Six field days were organized to demonstrate precision guidance systems along with in-row and close-to-the-row mechanical weed control devices. In addition, several radio, TV and farm journal interviews were given, further exposing growers to the project, its goals and its activities. Work on the mechanical weeding device, which lifts nutsedge tubers to the soil surface where high temperatures can desiccate and kill them, progressed. A prototype was built and tested, with several modifications made to improve performance. Plans were established to evaluate the unit's performance in field trials during the spring of 1998.

Work on the new mechanical tillage device commenced in May. The three-point hitch prototype consists of a blade, twin beater assemblies and a lifting/shaking chain. In operation the device penetrates the soil to a depth of six inches. The beaters break up the soil raised by the blade and then distribute it onto the shaker chain. The chain retains all but the smallest nutsedge tubers, while the soil falls through.

Originally the unit had one beater, with a second beater added to improve soil breakup and help distribute the material in a thinner layer on the chain. Following a series of tests the shaking chain was lengthened so as to better separate the soil from the tubers and ensure that they are deposited on the soil surface where the sun can desiccate and kill them. Other changes made during the prototyping phase included the addition of a PTO pump, to provide additional hydraulic flow, along with its associated components.

A few minor changes in the design are still planned, but the unit is essentially ready for testing next spring. A site for the trials has been identified and reserved for the tests. The trials will consist of operating the implement at different depths and speeds and then determining the percentage of tubers brought to the surface and the kill rates achieved. Plans call for these trials to be completed by early summer. A larger unit will then be fabricated for use in semi-commercial trials the following year.

Six field days were organized. These were set up to demonstrate some of the practices that can be employed to reduce herbicide use and hence grower costs. In each instance a precision guidance system and in-row weeding devices were demonstrated on cotton which had reached a growth stage of approximately 12 inches. This height is required to allow the use of precision guidance and in-row weeding techniques, since the plants must have sufficient stem size to permit sensing them, and also they must be able to resist the action of the in-row weeding devices.

In addition to demonstrations, the field days included discussions of applying Buctril on BXN cotton, Roundup Ultra on Roundup Ready cotton and Staple herbicide over-the-top, followed by a second post-directed herbicide application when a height differential between the crop and emerging weeds exists. Discussions about integrating over-the-top herbicide application with precision guided in-row cultivation into an economical production scheme also took place.

Of the six field days, all but one were held in farmer-cooperator fields. The other took place on one of the University of Arizona's Safford Research Center. In addition to the field days that were specifically set up for the project, all of the project participants attended in The University of ArizonaÆs annual cotton field day held in October at the Maricopa Agricultural Center. A poster display was prepared, and a cultivator was equipped with a precision guidance system and in-row-weeding devices so growers could inspect the equipment and ask questions about its operation. Approximately 600 people attended this event. In addition to these extension activities a number of radio, TV and press interviews were given during the cotton-growing season, each of which provided additional publicity for the project.

Potential Contributions

Adoption of mechanical weed control methodologies will have several benefits:

A. A reduction in hand weeding costs for annual morning glory and other broadleaf weeds, which range from $50 to $100/acre, to zero.
B. Reductions in weed competition, resulting in about a 10 percent increase in yields.
C. Reduction in chemical use through the elimination of pre-plant incorporated herbicides such as prometryn, which when used at a-rate of 1.2 to 1.6 lbs of A.I./acre costs on the order of $9 to $13/acre, to zero.
D. An increase in cultivating speed, resulting in a savings of fuel and labor costs as well as capital investment, since fewer machines would be needed for the same land area.
E. A more sustainable, cotton production industry.

Farmer Adoption and Direct Impact

Changes in practice. Approximately 10 articulated guidance systems for use with cultivators and 5 for use with other equipment were purchased during the 1997 cotton season. This is considered the beginning of widespread adoption of the practices demonstrated during the field days, since sales of these devices in Arizona in previous years were essentially zero.

Operational Recommendations: Placing band applications of dinituroaniline herbicides (Treflan and Prowl) on the bed top prior to planting, rather than broadcast applications in dry plant production systems, and using precision guidance systems in combination with close cultivation and in-row weeding techniques will reduce herbicide use and cultivation costs.

New Hypotheses

Reductions in herbicide use can be achieved by using precision guidance systems for early season band applications of Buctril, Roundup Ultra and Staple herbicides. Standard band applications are approximately 15 inches wide. With accurate spray placement this width can be reduced to about 8 inches, for about a 50 percent reduction in herbicide use. The use of reference furrows and furrow tracking devices is necessary for this to be commercially viable, however. Alternative methods of guiding sprayers when applying herbicide bands will be researched in the coming year.

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Annual Results

ACE #96-13

Control of Leafy Spurge by Grazing Goats, A Demonstration

Location:
Idaho

Funding Period:
July 1997 -

Grant Award:
$15,400

Project Contact:
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Kenneth Thacker, Bureau of Land Management

Cooperators:
Morgan Evans, Chairman, Right Hand Grazing Association
Kevin Koester, Chairman, Portneuf Soil and Water Conservation District
Pat Brown, Senior Resource Manager, Idaho Department of Lands

Objectives

The objectives of grazing leafy spurge with goats is to evaluate the economic and biological efficiency of this control method for managing leafy spurge.

1. To distribute the data and findings of the research project to practitioners and professionals throughout the region,
2. To develop information materials and displays providing data on the progress and results of the project.

Abstract

No findings to date since the project was unable to start up as planned in 1997.

Four farmers and ranchers attended the VIP Field Day on July 7, 1997

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ACE #96-14

The Impact of Riparian Vegetation Filters on Western Soil and Water Quality: Nonpoint-Source Pollutants from Range and Croplands

Location:
Wyoming

Funding Period:
July 1996 -

Grant Award:
$94,475

Project Investigator:
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R. Baumgartner, Goshen County Conservation District
S. Ross, Horse Creek Conservation District
R. Amundsen, Habitat Improvement, Wyoming Game & Fish

Objectives

1. Establish the rate, biomass production and N and P uptake by hybrid willow and grasses under greenhouse and field conditions of variable soil salinity.
2. Determine the impact of vegetation filters on N and P concentration and load in groundwater and streamflow.
3. Determine denitrification rates (spatially, seasonally, at various depths) in riparian soils before and after installation of vegetation filters and estimate the contribution of microbial denitrification to total nitrate removal from nonpoint sources before and after installation of vegetation filters.
4. Determine the physical effects of stubble height/grazing residue of grazed tall wheatgrass vegetation filters on sediment entrapment;
5. Determine differences in local and non-local landowner reaction to pro-active philosophy and strategy of the project and to determine the most effective methods of disseminating study results.

Abstract

Thirty cattle exclosures, each 50 X 100 m, were constructed and prepared for seeding in the Horse Creek riparian area on the Rottman Ranch, Hawk Springs, Wyoming, 15 on the rangeland side and 15 on the corn/alfalfa cropland side. Three replications (exclosures) per land type were planted with 1) hybrid willow cuttings in 6/97 or broadcast seeded in 3/97 to 2) tall wheatgrass, 3) creeping foxtail, 4) beardless wildrye or 5) basin wildrye.

All plantings failed to produce an acceptable stand because of excess salinity, drought, unfavorable seeding conditions or seed with low germination rates under saline conditions. These stands will be replanted in late winter and early spring, 1998 after new seed and varieties are tested in a germinator under saline conditions. Jose tall wheatgrass establishment in a greenhouse study using Horse Creek saline & saline-sodic soils was greater than 92 percent under salinity levels of 1.6, 3.5 and 6.8 deciSiemens (dS), but hybrid willows establishment was 93, 52 and 0 percent for 1.6, 3.5 and 6.8 dS, respectively. However, all surviving plants reached soil depths of 0.8 m within 150 days of growth and are therefore capable of extracting ground water during the first growing season.

Different nitrogen concentrations in both tall wheatgrass and hybrid willow subjected to different levels of salinity and N & P soil water concentrations and lengths of growing season indicate that grass and willow should be harvested and/or grazed every 90 to 120 days to maintain the optimum nitrate extraction plant vegetative stage and remove the maximum N from the riparian system. Grass and willow leaf, stem (willow only) and root weights, root distribution (%), shoot-to-root weight ratios and N concentrations per plant part and top and bottom soil column halves were determined for all treatments.

A comparison of Jose tall wheatgrass and the other three grass species tested in the field and greenhouse showed that Jose tall wheatgrass is the best adapted to high saline-sodic conditions. Plant uptake of N varies with salinity level, but the relationship is confounded by plant species and length of growing season before harvest. More research beyond the scope of this project is needed on soil amendments to mitigate the negative effects of salinity and on determining the optimum (i.e., N & P extraction; forage quality) leaf area and growth stage for different plant species, salinity levels, nutrient concentrations in ground water and interrelationships among soil water and organic matter contents, nitrate uptake and N denitrification.

Two scientific papers were written on this topic.

Site Information

The field study site is located in Goshen County on private land owned by the Rottman Ranch about 5 km north of Hawk Springs, Wyoming. This section includes 80 ha of irrigated alfalfa hay and corn on the west side, 140 ha of shortgrass plains on the east side and Horse Creek and its adjacent 40 ha of riparian soils/ natural vegetation flowing generally from south to north between the cropland and rangeland. Soils in the cropland were developed in wind-laid silt and are primarily Ulysses loam, 1 to 3 percent, class IIe-2, irrigated. This soil is 80 to 150 cm deep with a 36 cm A horizon with pH of 7.8 and 40 cm subsoil pH of 8.4. Rangeland soils were developed in wind-laid sands and are primarily Manter and Anselmo fsl, 0 to 3 percent, sandy range site, class IIIe-5, moderate fertility, moderately rapid permeability and moderate available water capacity. The riparian soils are generally deep, poorly drained alluvium, with alkali and/ or saline inclusions. Horse Creek in Goshen County is a fourth order, class 2 stream with no major impairments to designed uses.

Economic Analysis

The financial implications to ranchers of the project results to date are mixed. Indications are that riparian plantings should be fenced from grazing until established and then grazed in a rotation system to maintain the optimum vegetative stage for nutrient uptake from ground water. Fencing riparian pastures is extremely expensive because of their configuration. However, there are existing cost-share programs which encourage fencing riparian pastures for rotation grazing. In addition, greenhouse results indicate the capacity of both tall wheatgrass and hybrid willow to produce very high quality fodder that could be useful for flushing breeding animals or for animals with high nutrient requirements.

Potential Contributions

Saline riparian areas dominated by inland saltgrass produce about 6 AUM/ha whereas tall wheatgrass or hybrid willow pastures under nutrients levels common in these areas produce about 12 AUM/ha or twice the production and twice the quality (only under optimum management) of native saltgrass. In addition, tall grasses and agroforestry pastures produce critical winter cover for native game birds and ungulates. The greatest potential impact is that vegetation filters which must be harvested to remove extracted nutrients from the system and that reduce ground water nutrient loads to environmentally acceptable levels will justify the continued agricultural use of riparian areas and permit the continued use of upland range and cropland areas.

Farmer Adoption and Direct Impact

On the basis of results to date, cooperating ranchers have indicated their intentions to participate in a cost-share program involving fencing riparian areas for separate pastures. We recommend that tall wheatgrass (and similar tall saline-tolerate grasses) in riparian areas be test-harvested at different frequencies and seasons and analyzed for forage or hay quality to determine the optimum grazin and harvesting frequency to produce the combination of quantity and quality that best fits each rancher's total forage needs.

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Annual Results

ACE # 96-19

Influence of Cover Crop Vegetation on Symphylan (Scutigerella immaculata) Density in Vegetable Production Systems in the Pacific Nothwest

Location:
Oregon

Funding Period:
July 1996 -

Grant Award:
$40,000

Project Investigator:
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Brian Kreowski, Entomology, OSU
Ed Peachey, Horticulture, OSU

Objectives

1. Characterize arthropod and microbial community structure and trophic level changes (temporally and spatially) due to cover cropping and tillage practices in sweet corn cropping systems with specific reference to symphylans, beneficial arthropods and potential predators of symphylans in both microplot and on-farm research.
2. Evaluate cover crop and tillage impacts on weed population dynamics and sweet corn yield.

Abstract

Tillage and cover crop effects on arthropod and weed communities were determined in vegetable cropping systems. Cover crops were fall-planted preceding sweet corn in fall (direct seed) and spring (conventional tillage) systems in microplots at the OSU research farm in the third of three years. An on-farm trial compared fall-planted cover crops preceding squash in a spring tillage system. Soil samples for arthropod extractions were taken at three times: 1) before crop planting, 2) at canopy closure and 3) at harvest. Soil arthropods were extracted and counted from the soil samples with Berlese funnels. Symphylan traps were placed on the soil surface next to each soil extraction site and symphylan abundance was evaluated weekly throughout the season. The effect of cover crops on winter weed survival, summer annual weed emergence and sweet corn yield was determined.

Symphylans were least abundant in the Micah barley and oat plots in the on-farm trial with conventional soil tillage to incorporate the cover crop residues. Symphylans were most abundant in the common vetch plots. These results follow those of previous years and studies indicating that small grain cover crops such as Micah barley and Monida oat have the greatest potential to reduce symphylan populations in conventional tillage systems. However, in the same trial, we found that Diabrotica larvae (a root feeder on many crops) were more common following small grain cover crops than in the legume treatments of common vetch and crimson clover.

Microplot on-station research indicated that symphylan abundance during the sweet corn growing season was lowest following small grain cover crops of Wheeler rye and Monida oats in both conventional tillage and direct-seed systems. Symphylans were most abundant in the Micah barley and direct-seed systems that were not tilled in the spring before sweet corn planting. The ratio of macro predators to symphylans followed the trend of previous years with the highest ratio in the rye and oat cover crop treatments. Fungal biomass in the soil was greatest in the rye plots and lowest in the fallow treatments.

Nightshade and pigweed emergence was reduced by 90 to 100 percent by eliminating all spring tillage before sweet corn planting and direct-seeding through cover crop residues. When the soil was tilled before planting sweet corn, weed emergence was much greater regardless of cover crop type or residue biomass. In direct-seeded treatments, total weed emergence averaged two seedlings per m sq. whereas in the conventional tillage treatments emergence averaged 81 seedlings per m sq. Sweet corn yield in the direct-seed treatments was comparable to that of the conventional tillage plots, although average ear wt. of the direct seed treatments was 6 percent lower than the conventional tillage treatments.

Potential Contributions

Cover crops provide a source of carbon and energy for soil ecosystems. This energy may be used to restructure arthropod communities to the benefit of the crop and farming systems. Our data indicates that populations of several potential predators of symphylans may increase when moderate amounts of cover crop biomass are designed into the system. In some situations, symphylan populations have declined where cover crops were used. This could dramatically reduce the amount of pesticides routinely used to control symphylans in vegetable crop rotations.

Fall tillage with direct seeding (cross-slot planting) sometimes reduces the number of field operations in the spring for planting vegetables such as sweet corn. In other research, we have demonstrated that reduced cultivation and herbicide rates can be integrated. However, farmers must learn a completely new production system, often requiring a substantial investment of time and resources over several years.

Farmer Adoption and Direct Impact

Changes in practice. Integration of cover crops is increasing among farmers, but use is constrained because of perceptions that cover crops add management complexity and cost to systems that already have low rates of return. Long-term benefits are outweighed by the immediacy of current economics. If symphylan populations can be manipulated by cover crop components, this will provide an additional incentive to adapt cover crop strategies. Specifically, soil insecticide and herbicide use may decrease and allow more selective pesticide usage that would minimize impact on other important soil predators and vegetable rotations. The result may be multiple consequences and tradeoffs that encourage growers to make knowledgeable choices.

Our purpose involves determining consequences or impacts of fall and spring tillage systems on various biological components of soil systems; not to recommend. However, evidence suggests that cover crops may either increase or decrease symphylan populations, depending on cover crop species and growth pattern. Growers should carefully consider the type of cover crop based on these findings. More important is the observation that many important generalist predator populations are enhanced by adding cover crops during the fallow season or by minimizing early season tillage disturbances.

Farmer Comments

Producer involvement has been principle in giving direction to the research trials. This had included design of the trials, selection of cover crops and evaluation of results. University personnel have primarily been involved in data collection. This involvement has led to some non-traditional approaches. For instance, in the on-farm trial, the participating grower suggested that cover crop treatments that apparently reduced symphylan populations in 1996 be planted on plots that were previously planted to cover crops that increased symphylan abundance. Even though this confuses long-term analysis of the successive effects of the same cover crop from year to year, it emphasizes the priorities of the producer; i.e., positive and immediate effects on arthropod communities.

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Annual Results

Professional Development Program #95-02

Sustainable Noxious Weed Management on Northwestern Rangelands

Location:
Pacific Northwest and Montana

Funding Period:
July 1996 –

Grant Award:
$43,800

Project Investigator:
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Objectives

1. The overall objective is to provide the Cooperative Extension Service, Weed Conservation Districts, Soil Conservation Service, Agricultural stabilization and Conservation Service, Farm Home Administration and other appropriate agency personnel in the Pacific Northwest and Montana the knowledge and educational materials necessary to competently teach integrated and sustainable noxious rangeland weed management at a local or state level.
2. The training manual and workshop will include criteria for evaluating, selecting and integrating sustainable weed management practices on a whole ranch basis, consistent with existing IRM (integrated ranch management) or TRM (total ranch management) programs.
3. The training manual and workshop will incorporate the sociological factors that influence the adoption of integrated and sustainable weed management strategies, including the relationships between the environment, social structure and weed management and ranching operations.

Abstract

Eleven group leaders have organized a working group made up of people representing those agencies and personnel who will be using the educational program to ensure "buy-in". Each group leader is in the process of facilitating the development of a "hands-on" workshop, activity and presentation for their specific portion of the project. The specific portions are 1) noxious weed identification, 2) principles of integrated and sustainable weed management, 3) weed biology and ecology, 4) preventing noxious weed invasion, 5) detecting, eradicating, or containing noxious weed infestations, 6) principles of integrated and sustainable weed control, 7) grass management, 8) revegetation, 9) economic sustainability of weed management and range livestock systems, 10) sociological sustainability of weed management and range livestock systems and 11) sustainable weed management and whole ranching operations. Several demonstrations of sustainable weed management have been established to be used in workshops designed to introduce educators and agency personnel to using the manual, give direct information about integrated and sustainable noxious weed management and provide an opportunity to interact with major participants of the educational program.

The adoption of the educational program to be developed as a result of this project is dependent upon the "buy-in" from those professional educators who might use this program. Therefore, we have made a concerted and conscientious effort to solicit individual working group "team leaders" with the commitment to develop a strong and effective working group. A major effort has been made toward developing working groups comprised of quality and key individuals within each agency or affiliation, who will implement the program once its completed. At this point, each working group is in the process of developing a 2-3 hour "hands-on" workshop for each chapter of the workbook or manual.

The workshops focus around a few key points that can be emphasized with interactive and innovative activities. An example would be a series of herbarium mounts along with a simple key for noxious weed identification (chapter 1). This approach allows the participants to actively work on identifying the main characteristics of the weed and view all the parts of the plant (seed, flower, roots) in detail. This method will provide the students and understanding of the subject and allow them time to interact with their instructors, reinforcing the lesson.

Several demonstrations of sustainable weed management have been established to be used in workshops designed to introduce educators and agency personnel to using the manual, give direct information about integrated and sustainable noxious weed management and provide an opportunity to interact with major participants of the educational program.

The first demonstration area was developed near Ennis, Montana, in June 1996. This demonstration site is located in the MWCA Southwestern area and displays 49 different integrated spotted knapweed management techniques. Expansion of this site is planned for the spring of 1997 and includes biocontrol releases and signs for a self-guided tour. A demonstration area on leafy spurge was also set up in June of 1996, at the Trap Club near Ulm, Montana, which is located in the MWCA triangle area. This demonstration consists of 43 plots on integrated leafy spurge management. An additional 12 plots are located at a nearby fishing access combining cultural practices with biocontrol releases. In July 1996 a second leafy spurge demonstration site was developed in the MWCA Southeast area near Terry, Montana. The site was fenced and contains 44 plots on integrated leafy spurge management. The site will be expanded in the spring of 1997 to include integrating sheep grazing with other control methods. A similar demonstration on leafy spurge consists of 45 plots and is located near Glasgow, Montana, in the MWCA Northeastern area. Further development of this site is slated for spring of 1997 and includes integrating biocontrol with other management techniques. A spotted knapweed demonstration area was set-up near Corvallis, Montana, in the MWCA Western area that displays several alternative management techniques (steam, handpulling, etc.). This plot is in cooperation with the Ravalli County Weed District and several area special interest groups. Plans are underway for several more demonstration areas in the MWCA Western, Southwestern, Southcentral, Central and Triangle areas. These demonstrations will be developed in the fall of 1996 and spring of 1997.

Positive Contributions

As a result of this project, we have developed a new method for developing and implementing ecologically-based integrated weed management. This has resulted in a manuscript entitled "A theoretical framework for developing successional weed management strategies on rangeland" by Roger Sheley, Tony Svejcar and Bruce Maxwell printed in Weed Technology. This paper provides an ecological basis for integrated weed management that can be used to guide the development and implementation sustainable weed management. This will be a major focus of the educational program developed as a result of this SARE grant. A copy of the manuscript is attached.

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Annual Results

Professional Development Program #95-03

Agency Personnel Training in Riparian Monitoring and Management of Wildlife and Livestock in the Intermountain West

Location:
Wyoming, Montana, Idaho

Funding Period:
July 1995 –

Grant Award:
$98,000

Project Investigator:
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Objectives

1. Conduct workshops for Western Region agency personnel aimed at developing expertise in providing riparian monitoring and management education to local ranchers.
2. Develop demonstration areas to show on-ground practices for managing herbivore (livestock and wildlife) use of riparian areas.
3. Develop demonstration areas to illustrate strategies for monitoring wildlife vs. livestock use of riparian areas.
4. Develop demonstration areas to demonstrate strategies to lure herbivores from riparian areas using salt, fertilizer, supplement and water.
5. Conduct demonstrations to illustrate the need a) to develop riparian condition goals and b) to utilize effective and economical methods of monitoring livestock use of riparian areas.
6. Summarize results and strategies in publications and handbooks.

Abstract

The sustainability of livestock operations in the intermountain west is often dependent on the sustainability of riparian areas. Many producers rely on personnel within the Cooperative Extension Service (CES) and the Natural Resource Conservation Service (NRCS) for assistance and expertise in management and monitoring of riparian areas. The purpose of this project is to increase the understanding and proficiency of Western region agency personnel so they can conduct educational programs and develop demonstration areas at the local level and respond to client needs in sustainable riparian management.

A unique aspect of this project is that we will teach others to become teachers. In this way the multiplying effect of the effort will be maximized. During the first year of the project we have developed the demonstration areas that are used during the training session, the first of which was held last summer. Cross-riparian drift fences, off-site waterers, off-site fertilizer plots and other management demonstrations have been installed. The area for wildlife vs. livestock grazing demonstrations has been completed. Coordination to identify appropriate contacts to maximize workshop attendance has been completed between Montana, Idaho and Wyoming. Because demonstration areas are in all three states, a great deal of logistical planning was necessary to ensure efficiency during workshops.

A three-day workshop for county agents of the NRCS was held August 19-21, 1997. A total of 32 CES, NRCS, ranchers and CES/University participants attended. Pre- and post-workshop evaluations were used to direct next summer's workshop. The 1998 workshop will include invitations to CES, NRCS and public land management agencies in the Western region.

Installation of demonstration areas began during the first year of the project. These demonstrations are used as field trip teaching sties during the workshops. Additionally, information collected at the sites is presented and provides workshop participants with a better understanding of the value of demonstration areas in their training programs. Two cross-riparian drift fences were built on Alan Carter's and Andy O'Hara's ranches south of Livingston, Montana. Sixteen elk-cattle exclosures were built on the Bandy Ranch near Ovando, Montana. Demonstration areas to monitor the effect of grazing on forb production were also located at the Bandy Ranch. Off-site waterings, fertilizer, salt and supplement demonstration areas were established in numerous locations in northern Wyoming, eastern Idaho and in southwestern Montana. These areas are the primary focus of the workshop and serve as illustrations of riparian management and monitoring. Originally, two training workshops were planned for the same year. To ensure availability of the most qualified workshop instructors, including rancher and commodity group participants, the coordinating committee has decided to focus on one workshop each year. One has been com-

pleted and the second workshop will be held next summer. Because of the positive response to the workshop, it is anticipated these two SARE-sponsored workshops will provide impetus for advanced riparian management workshops to be conducted annually.

A long-term goal of the project is to establish demonstration areas that will serve as a continuous illustration of various riparian management and monitoring strategies. The benefits of the project will continue after the project completion date as future training sessions utilize information and demonstrations developed as a result of this effort. It is anticipated that educational institutions, agencies, special interest groups, ranchers and interested citizens will be involved in programs that will use the demonstration areas as teaching tools.

In addition to the workshops, information will be disseminated through a workshop publication. Workshop trainers are now in the process of preparing a handbook that describes strategies and new techniques identified and developed during this project.

Potential Benefits

To sustain ranches in the intermountain west, ranchers must become active managers of riparian areas. This includes an understanding of riparian processes, the ability to define what they hope to achieve through riparian management and the ability to monitor the progress they are achieving through their riparian management program. The most logical and effective way to provide this knowledge and ability to ranchers is through local county extension agents and Natural Resource Conservation personnel. The purpose of this project is to provide the training necessary for CES and NRCS to fulfill this role in the Western region and to develop demonstrations of successful riparian management strategies on working ranches.

Impacts on Agricultural Professionals

Through pre- and post-workshop evaluations, we are able to quantify the pre- and post-workshop changes in competence and attitude of participants. These results, which indicate significant benefits of the training, are summarized below.

Prior to the workshop, 53 percent of the participants indicated riparian management was in the upper 10 percent of priorities in natural resource management. After the workshop, 69 percent of the participants felt riparian management was in the upper 10 percent of natural resource management priorities.

Prior to the workshop, only 62 percent of the participants felt capable or very capable of teaching other about riparian management. After the workshop, 92 percent felt capable or very capable of teaching riparian management. Additionally, there was a 15 percent increase in the number of participants who now feel very capable of teaching riparian management.

Prior to the workshop, only 76 percent of the participants felt capable or very capable of teaching riparian monitoring versus 92 percent who felt capable or very capable after the workshop. The number of participants who felt very capable of teaching riparian monitoring increased 23 percent as a result of this workshop.

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Annual Results

Professional Development Project #95-08

Sustainable Integrated Range Livestock and Crop Production Systems

Location:
Nevada, California, Oregon, Idaho

Funding Period:
July 1995 –

Grant Award:
$106,720

Project Investigator:
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Objectives

1. Through education programs, develop a cadre of individuals competent to teach sustainable integrated range livestock and crop production systems.
2. Provide education programs on range livestock and crop production systems that optimize water management and quality.
3. Provide education programs that identify livestock production systems compatible with wetlands and aquatic bird habitat management objectives.

Abstract

A major portion of the crops in the western arid range states are grown for livestock consumption. Crop residues and crop industrial wastes provide important livestock feed resources and additional income to farmers and industries. There is clearly a high level of synergism and dependency between sustainable range livestock and crop production systems in the west. This project proposes to develop and implement training programs in at least 7 states in the following 3 areas: 1) integrated range livestock and crop production systems, (2 watershed management and crop water conservation and (3) livestock production systems compatible with aquatic bird habitat and wetlands management objectives.

Jim Oltjen is currently conducting session to educate county extension personnel and others on the use of the back in the black software and concepts. Ron Torell will present his educational material to the COIN group (a group of extension educators form the states of California, Oregon, Idaho, and Nevada) in January as well as the Nevada Cattlemen's College in May. Further dissemination when projects are completed will be through meetings, publications and the electronic media including email and web pages.

Potential Benefits

When the project is complete, there will be a greater understanding of using of irrigated pasture as a supplement or an alternative to public rangelands in beef cattle and sheep production systems. Further guidelines will help to use crop residues and supplemental crops by livestock to enhance livestock productivity, crop land fertility and farmer income. A computer program, to run under Windows, will be used interactively to play out various possible scenarios for each individual application. The program will consider the effects on livestock growth with the use of pasture, native range, crop waste, irrigated pasture, croplands, and feeding of various purchased feeds. Effect on wildlife under various management schemes will also be incorporated. These potential benefits will enhance both sustainability and profitability of agriculture.

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Annual Results

Professional Development Program #95-12 (previously #94-06)

Sustainable Agriculture Training Project: A Model of Collaborative Learning

Location:
Idaho, Washington, Montana, Utah and Wyoming

Funding Period:
July 1995 –

Grant Award:
$31,450

Project Investigator:
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Cooperators:
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University of Idaho Cooperative Extension
Washington State Cooperative Extension (WSU Extension)
Idaho Rural Council (IRC)
Idaho Natural Resources Conservation Service (NRCS)
Idaho RC & Ds

Objectives

1. To refine the training model we developed with our existing project and to maximize its use so it can be replicated by others.
2. Train a cadre of trainers in five states, primarily in Montana, to a) deliver training programs in sustainable agriculture to technical assistance providers from public, federal, state, local and private agencies and organizations, and b) develop partnerships with individual farmers/ranchers and farm improvement clubs to help them design, test and adopt more sustainable agriculture practices.

Abstract

This professional development program targeted five states in the Intermountain West: Montana, Idaho, eastern Washington, Wyoming and Utah. We used the evaluation of the program in Montana to improve the program we offered previously in Idaho.

The program in Idaho was a logical extension and improved version of the one conducted in Montana. This year's program included a collaborative effort to plan and design a professional development training program involving agency leadership in Idaho and Washington, PCEI, IRC and AERO as well as two-day professional development training workshop and farm tours in Idaho. We sponsored over 20 farm tours and workshops hosted by farm improvement clubs across Montana, Idaho and eastern Washington; a tour by WSU Extension's Ag Horizons team, whose focus is sustainable agriculture, of exemplary farms in Montana a small grants program for agricultural service providers wanting to initiate projects or activities designed to help them and others learn more about sustainable agriculture; a chronicle which others can use to conduct similar programs elsewhere; an AERO co-sponsored workshop on composting at Montana State University; a session at MSU's Crop Pest Management School and two annual gatherings of farm improvement clubs – one in Montana and one in Idaho. Farmers and ranchers were an integral part of each piece of the training. This program affected well over 400 people in the region.

The training events themselves served to disseminate information beyond the trainees to farmers and ranchers and federal and tribal personnel who attended some of the training events. The most effective dissemination seemed to come through face-to-face contact between and among trainees and farmers and ranchers, primarily farm improvement clubs.

This year we will publish a chronicle documenting the process and content of our training, which others can use. This is the primary means we will use to disseminate what we have learned about how to conduct an effective professional development program.

Reactions from Farmers and Ranchers

This program has resulted in a cadre of agency technical assistance providers in five states, primarily in Idaho and Montana, who are learning new approaches for serving farmers and ranchers and rethinking their roles. Here is how the program impacted a few participants:

"When the energy of community is there, agencies should step back and just provide logistical support and help facilitate. This project will change the way we [resource conservationists with NRCS] do this kind of work in the future. Our tour was planned by a team of agency people and ranchers, with ranchers taking the lead. The result was a tour that many said was the best they had ever been on."

"As an agronomist I realize that my role [when working with farmers] should be more of a facilitator. This workshop helped me do that."

"I'm learning that things are changing. The outside expert approach is dying and the collaborative approach is the coming thing."

As a result of the program, farmers and ranchers involved in sustainable agriculture in Idaho and eastern Washington are noticing more support for and interest in their projects by local agency technical assistance providers. Nancy Taylor, coordinator of northern Idaho's farm improvement clubs supported by PCEI said, "This year [1996] farm clubs are telling me that it has been much easier to garner support from local Extension agents and resource conservationists for their projects."

Impacts on Agricultural Professionals

The success, to date, of this Chapter 3 professional development program includes 1) nurturing a network of agency leadership, who helped plan the training, that will provide on-going support for their field staff working with producers engaged in sustainable agriculture; 2) expanding the regional network of professionals who understand the principles of sustainable agriculture and collaborative learning and can provide each other with support and information; and 3) trainees that understand that sustainable agriculture is about more than practices – that systems change is complex and requires problem-solving skills and facilitation rather than simple question-answering.

AERO offered small grants to agricultural service providers wanting to initiate projects or activities designed to help them and others learn more about sustainable agriculture. We offered five $800 grants to agricultural service providers in the five-state region being served by this grant (Montana, Idaho, Washington, Utah and Wyoming. We received eight proposals, six from Idaho, one from Wyoming and one from Montana. Two people in Washington are still considering applying. We funded three projects in Idaho and one in Wyoming. We have one more grant available.

Positive Impacts and Contributions

The trainees' interest and work in sustainable agriculture has gained credibility within their agencies as a result of the training program – both its content and visibility. Besides increased credibility, the training program's impact is three-fold: First, involving agency leadership in the planning process created a network that supports field staff's involvement in sustainable agriculture on-the-ground. Second, by holding our second training in Idaho, we have expanded the network of professionals who understand the principles of sustainable agriculture and collaborative learning and can provide each other with support and information. And third, trainees understand that sustainable agriculture is about more than practices – that systems change is complex and requires problem-solving skills and facilitation rather than simple questions and answers. Trainees are learning new approaches for serving their clientele and rethinking their roles. In fact, farm improvement clubs in Idaho are reporting an increased level of technical assistance from agencies in their projects as a result of this Chapter 3 program.

New Hypotheses and Future Recommendations

This professional development program benefited from two consecutive years of funding. This year's program in Idaho encompassed the best elements of the program we offered the year before in Montana, resulting in a more effective program. We have learned a lot about leading a Chapter 3 professional development program. The program must cover not just what sustainable agriculture is and how to go about it, but how to best serve producers interested in it. This means acquiring both an understanding of new roles and processes of inquiry and support and technical knowledge. Real life farmers and ranchers are invaluable as trainers, and are integral to each part of the program. Incorporating the farm tours into the core training gave participants a chance to mesh theoretical learning with experiential learning, and ensured a continuity of participation. Having written case studies about the farms on the tour is an effective way to prepare participants for the visits. It is important to encourage public agency ownership in the program by involving them in the planning and implementation process. Involving public and private organizations in the planning and implementation process fosters new roles and relationships. It is most effective to engage a few high quality trainers. We believe that participants were able to delve deeply into a few topics by giving a few trainers more time for their sessions. It is important to ensure that the trainers communicate a consistent message of a sustainable agriculture approach. Two and a half days for the core training is adequate.

Reported in 1997

Western Region
Sustainable Agriculture Research and Education
Utah State University
ASTE Building
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Logan, Utah 84322-2310

Annual Results

Professional Development Program #95-15

A Consortium-based Sustainable Agriculture: Training Curriculum Plan (SATP)

Location:
California

Funding Period:
July 1995 –

Grant Award:
$20,000

Project Investigator:
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Daniel Mountjoy, Soil Conservation specialist, USDA-NRCS, Salinas.
Jose Montenegro, Executive Director, Rural Development Center, Salinas

Objectives

1. Organize a sustainable agriculture curriculum plan in a format pertinent to the training needs of University Cooperative Extension, USDA, and other appropriate extension agency personnel.
2. Develop a consortium list of experts with sustainable agriculture training and teaching experience comprised of CASFS affiliates, Cooperative Extension and USDA personnel, farmers and agricultural professionals, and consultants.
3. Conduct, with additional funds, trainings involving seminars and direct field experience with sustainable agricultural systems, utilizing the curriculum plan for the intended audience.

Abstract

The consortium-based Sustainable Agriculture Training Program (SATP) curriculum plan at the University of California, Santa Cruz Center for Agroecology and Sustainable Food Systems (CASFS) is comprised of twelve modular units on topics selected from priority subjects and clientele cited in the 1995 California Statewide Plan for Professional Development and In-Service Education in Sustainable Agriculture, coordinated by the University of California Sustainable Agriculture Research and Education Program, Davis.

Each module (designed for periodic review and updating) consists of a brief referenced introduction and a topical outline (to focus seminar or training discussion), whole-farm case studies guide and citations, practicum/field training exercises, and information, networking and literature/media services. A list of consortium members with expertise as seminar or training leaders is also included in each module.

Potential Benefits

The CASFS SATP plan is designed to allow trainees to achieve the following knowledge:

1. Understand the modern principles and practices of agricultural sustainability, the interaction between agriculture and the environment, and the importance of protecting resource quality, wildlife, human health and ecological balance in agricultural systems.
2. Understand how sustainable agriculture farmers function as an entrepreneurs in a competitive environment, including the concepts of risk management in an increasingly regulated environment; and understand the comparative agronomic and economic differences between sustainable, transitional, or organic production systems and conventional production and marketing systems.
3. Understand technical management principles and production practices characteristic of sustainable production, including practical approaches to biologically-based soil and plant fertility, composts and other amendments, biorational pest management, machinery, inputs, and equipment, and processing, quality control, and marketing.
4. Understand how to access research results, information sources, practical guidelines, production systems examples, and mentor-trainers from multiple information sources in the sustainability movement.

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Annual Results

Professional Development Program #96-02

Improving Manure Management to Protect Water Quality in the Southwestern United States

Location:
New Mexico, Utah, Colorado

Funding Period:
July 1996 –

Grant Award:
$60,000

Project Coordinator:
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Bill Wailes, Dairy Specialist, Colorado State University Cooperative Extension

Objectives

1. To demonstrate and encourage the use of best management practices (BMPs) for poultry, lagoon and feedlot operations within the animal production units and in crop production systems in the field.
2. To educate NRCS and Cooperative Extension personnel in methods of livestock waste utilization within the framework of western U.S. agriculture.
3. To revise and update NRCS guidelines for livestock waste management to address specific concerns for western U.S. climates, soils and cropping systems

Abstract

The purpose of this project is to improve the use of manure as a fertilizer that is applied at agronomically and economically sound rates and to reduce fertilizer applications accordingly, so that water quality is protected. We have held the first of six workshops to train Extension and NRCS personnel in nutrient management planning using a case study approach. Sixty percent of the appropriate Utah field staff attended this workshop. We have begun writing the Western Agriculture Waste Management Field Handbook, which will be a valuable resource for field personnel. In the spring we will continue in-field demonstrations of manure management practices which will protect water quality.

Due to the late arrival of the SARE funds (September 1997), only one BMP demonstration was accomplished that year. The demonstration, carried out on the Hafliger dairy in New Mexico, compared manured (15 tons/acre) and conventionally fertilized corn silage production. Manure spreader calibration was demonstrated prior to application. The yield and nitrogen, phosphorus and potassium levels in the silage were significantly increased by manure use. Demonstrations of manure management BMPs will continue in Spring 1998.

The first of six training workshops on methods of livestock waste utilization was held in Park City, Utah, on August 18, 1997. This training was held as part of the 1997 Utah Nonpoint Source Water Quality Conference. Forty-five NRCS, 22 extension and 23 other personnel attended the workshop. Additional attendees were from the Environmental Protection Agency, state departments of environmental quality, state departments of agriculture and food, conservation districts, planning commissions and producers.

In the morning, we toured a local dairy, observing liquid manure handling, solid manure storage and field application. In the afternoon participants learned how to develop a nutrient management plan for that dairy, including manure production quantity, field acreage, alternatives for handling and storing manure, manure rate calculations and manure application methods. The Kohler dairy is typical for Utah, with approximately 100 milking cows, a limited land base for manure utilization, on site manure handling and storage constraints and increasing urban development pressure. The classroom training was concluded with a short session demonstrating manure management software programs. The training was supported by a handbook containing reference materials.

Similar workshops are scheduled for February 12, 1998, in Fort Collins, Colorado, and April 1998 in Las Cruces, New Mexico. A second series of workshops will be held in Fall 1998 through Spring 1999 after completion of the Western Agriculture Waste Management Field Handbook. This workshop will serve as an introduction to the new handbook.

To revise and update NRCS guidelines for livestock waste management to address specific concerns for western U.S. climates, soils and cropping systems, we have written an outline for the Western Agriculture Waste Management Field Handbook, intended to serve as an addendum to the NRCS Agriculture Waste Management Field Handbook. Each of the three Principal Investigators will write three chapters.

In 1997, we wrote three newsletter articles and five other extension publications on manure management. A Web page to highlight this project is under development. The field demonstrations will be marked with large signs visible to passers-by and one-page information sheets about the demonstrations will be available to the public in a protected box below the signs.

The Web page will describe the demonstrations and show their locations. In addition, the demonstrations will be included in summer field days. This year, results from the New Mexico demonstration were discussed with the New Mexico chapter of the Soil and Water Conservation Society and the New Mexico Haygrowers Association.

Potential Benefits

Trainees will be better able to assist producers in manure management problem solving. In particular, the 1997 SARE-funded training improved cooperation between Extension and NRCS in Utah. Prior to this training, members of both agencies separately assisted producers in developing manure management plans. In the past, two plans for the same farm, developed by different agencies, could differ significantly because each agency relied on different reference materials and guidelines for manure management. Preparation of training materials and sessions for the manure management training brought these differences to light and have motivated personnel from both agencies to develop a common set of guidelines for all in-state personnel to use. Extension specialists and NRCS agronomists are currently cooperating on the development of these guidelines in the form of parallel Extension bulletins and NRCS conservation standards.

Impacts on Agricultural Professionals

The training was evaluated with a one-page survey given out immediately after the session and a second evaluation as part of the larger Water Quality Conference. Thirty-eight participants responded. All thought the field, classroom and written materials were necessary for the training and the majority thought the training was well done.

The evaluation gave participants the opportunity for written commentary on the training. Many interesting comments came from Extension, NRCS and EPA participants. Several Extension and NRCS personnel commented that suggested improvements in manure storage facilities would be too expensive and the rates of manure application calculated too low to be economical or feasible to implement by farmers. In contrast, an EPA participant thought that recommendations and calculations reviewed during the training were too liberal and that the final management plan called for the application of too much manure.

A total of 14 Extension front-line personnel and 41 NRCS field personnel participated in the training. These numbers represent over 60 percent of the Utah Extension and NRCS personnel in positions that require them to assist farmers in developing manure management plans. Therefore, the training reached a significant number of agricultural professionals in Utah. No agriculture consultants participated in the training; however, Utah has no full time agriculture consultants, and the few part time consultants in the state are employed by the inorganic fertilizer industry.

Reactions from Farmers and Ranchers

The New Mexico demonstration changed the perception of the value of manure for the cooperating farmer and other farmers in the area (15 individual farmer visits). Previously, manure had been considered a soil amendment, and the fertilizer value was considered unimportant. Now these producers have confidence in manure's value as fertilizer.

New Hypotheses / Future Recommendations

The Utah workshop was very successful, and we plan to emulate it in Colorado and New Mexico. We will also add a brief session on state regulations as they impact manure management.

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Utah State University
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Annual Results

Professional Development Project #96-04

Extension Faculty Learning with Farmers - A Seminar Series on Sustainable Agriculture

Location:
Washington

Funding period:
July 1996 –

Grant Award:
$36,424

Project Investigator:
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Objectives

1. Educators and researchers together will learn about sustainable agriculture opportunities for dryland farming.
2. Extension faculty, researchers, and farmers will develop ideas for on-farm research to test sustainable agriculture concepts.
3. The Ag Horizons team will develop a summary document on the project for use by extension faculty in other states and also one-page fact sheets on individual seminars for distribution to farmers in eastern Washington.

Abstract

The Ag Horizons team of Washington State University Cooperative Extension faculty is committed to providing eastern Washington producers with an understanding of the agronomic, economic, ecological and social impacts of agriculture and to promoting the adoption of practices that sustain the natural resource base for future generations. The purpose of this project is to educate the Ag Horizons team, along with other Extension faculty, researchers, and producers about the possibilities and options for developing agricultural management practices and markets that will sustain eastern Washington farms and farmers in the post-Farm Program era.

During the first year of the two-year project, the Ag Horizons team sponsored eight seminars on a variety of agricultural topics. They were taking out conservation reserve program grassland, value-added markets for crop fiber and residue, farm policy update, residue burning in conjunction with no-till seeding of winter wheat, value-added opportunities for eastern Washington agriculture, grower experiences with alternative crops, organic grain production and expanding swine production.

We held the seminars in different locations and communities around eastern Washington in order to foster relationship with different grower groups. We advertised the workshops through our newsletter (circulation 1,800), flyers, county newspapers, and radio stations. Extension colleagues, NRCS, and Conservation Districts are on our mailing list.

Consistent with our goals of learning alongside farmers, we also included farmers as speakers whenever possible. Including producers as workshop participants – both as speakers and as audience – adds a dimension and level of reality that is popular with other producers and is sometimes lacking from "expert" perspectives. Researchers can be too focused and reductionist, omitting vital questions such as, "What is the economic bottom line?" Farmers must run their farms as businesses, and net income determines their ultimate success.

The number of seminar participants ranged from 7 to 71 with an average of 39. The number of Ag Horizons team members at the meetings averaged six, so the project is impacting far more than the original intended audience. Under the Freedom to Farm Bill, producers in the region are hungry for alternatives to the traditional production commodities and practices, and this seminar series is meeting a real educational need.

The Ag Horizons team completed a pre-project evaluation of our knowledge of opportunities that will sustain agriculture in the region, and we will evaluate our expanded knowledge level at the completion of the project. Evaluations from individual workshops showed that understanding of the topic was always increased among seminar participants. Frequently they identified priorities for further research and education, including two major alternative crops that the Ag Horizons team will include in on-farm rotation demonstrations. Several producers also want to start a support group for potential organic farmers because of a workshop on organic grain production.

Several report were written following the above seminars. Articles in the Ag Horizons newsletter have a circulation of 1,800 across Spokane, Lincoln, Adams, and Douglas Counties in Washington State.

A video produced on the pulping process for grass straw (value-added fiber products) was later shown at least eight times to different grower groups across the region, including to Spokane County Commissioners, hay growers, and to Lincoln County Wheat Growers. It was not paid for by SARE funds, but was used in the workshop.

Positive Impacts and Contributions

The project has already demonstrated great potential for increasing the Ag Horizons team's ability to respond to grower educational needs. The wide diversity of subjects has increased our exposure to topics that we would otherwise not know much about. From comments made by team members, I believe that we are more optimistic and knowledgeable about agricultural opportunities and are more open to working in new areas than we were before. We have used information gained to develop research priorities for on-farm testing and to initiate a support group for potential organic producers. The complete seminar series will further increase our awareness and expertise on ways to enhance sustainability of agriculture in our region.

Impacts on Agricultural Professionals

Evaluations from individual workshops showed that participants increased their knowledge on CRP rules for take-out and scientifically developed methods for doing this.

As a result of the seminar on value-added markets for crop fiber and residue, the Ag Horizons team is able to provide relevant information to interested clientele. Grower participation in this meeting showed that there was little local support and leadership to develop a plant producing paper pulp from straw, which we had previously considered the most viable option. Other businesses, including a fiber board plant, methane and compost from straw, plastics from straw, and straw homes are getting started in the area.

The Ag Horizons team toured farms in Columbia County (southeast Washington) where growers are practicing stubble burning to reduce heavy residue levels before direct seeding winter wheat. The team learned the research results from the area and saw how the practice has reduced soil erosion on steep slopes. However, they remained unconvinced that the practice has a long term future, especially as field burning is being prohibited in Spokane County and other counties will likely follow suit.

The seminar on value-added crops increased awareness of alternative crops and value-added commodities for 38 percent of seminar attendees. Participants (primarily growers) rated safflower and mustard as the most promising alternative crops for the region for profitability, environmental soundness, and bringing in new businesses. This will affect crop rotations the Ag Horizons team plans to demonstrate under direct seeding in on–farm tests across the region. Sixty-two percent of participants concluded that organic grain production was more feasible for the area than they had previously considered it. Five growers wanted to form a support group for interested producers. Seminar participants concluded that waste management regulations would be a primary issue with expanding swine production in the area, and wanted to learn more about them.

Reactions from Farmers and Ranchers

Attendance at our meetings has been very good. Farmers are freely participating and learning with the extension agents. At the Organic Grain production seminar, a life-long area producer stood up and said, "I wish I had been able to attend a workshop like this (on this topic) forty years ago!"

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Annual Results

Professional Development Program #96-09

Sustainable Soil Management—Educational Resources for Extension Professionals in California's San Joaquin Valley and Central Coast Regions

Location:
California's San Joaquin Valley and Central Coast

Funding Period:
July 1996 –

Grant Award:
$98,773

Project Investigator:
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Objectives

1. Coordinate, test and document a participatory process for determining educational needs and objectives related to sustainable agriculture in the target area and develop high quality curricula and educational packages for the identified needs. (By curriculum, we mean an integrated educational package of written materials, video and electronic media, hands-on activities, field demonstrations and follow-up aimed at providing practical instruction on topics related to sustainable agriculture.)
2. Produce two educational packages that can inform and be used by Cooperative Extension (CE) advisors and Natural Resources Conservation Service (NRCS) personnel to enhance extension and outreach programs related to sustainable agriculture in the San Joaquin Valley and Central Coast region (one educational package for each area).
3. Evaluate both the product and the curriculum development process and suggest ways to improve and adapt the process to other locations throughout California and the Western Region.

Abstract of Results

This two-year project is aimed at developing educational resources that CE advisors and NRCS field staff can use in working their clientele who are interested in developing more sustainable farming and ranching systems. The project managers are committed to a collaborative team-based approach to developing these resources. Ownership of the process by CE and NRCS personnel in particular will ensure that a) we are addressing priority areas for education and not duplicating curricula that have already been developed; b) what is developed is responsive to the needs that exist in the field, farm, ranch, or community; and c) the educational packages and instructional materials are in a form that is appropriate for and adaptable to the work of the extension professionals who will be using them.

During this first year we have successfully formed two educational resources development and education teams: one for the San Joaquin Valley and one for the Central Coast. Through facilitated discussion and the use of focus group techniques, these teams have assessed the educational needs related to sustainable agriculture in their region, established a list of priority topics and issues and defined the educational objectives for their highest ranked priority. Both groups identified sustainable soil management as their highest priority. Each team is continuing to play an active role in the development of a resource package on this topic, tailored for their specific location.

A first draft of the guide is being developed and will include print materials (journal articles, books popular press, manuals information sheets, assessment kits), Internet references, video and slide resources and other relevant items. This draft will be mailed to each team member in mid-January. Second team meetings are scheduled for the end of January, when all materials will be reviewed and discussed in detail. In the second year of the project we will be completing the resource guide, evaluating and testing it at a number of venues and disseminating it throughout the state and region. The two teams that have been formed will continue to play an integral part in this second phase of the project.

The sustainable soil focus is now reflected in the new title for the project: "Sustainable Soil Management—Educational Resources for Extension Professionals in California's San Joaquin Valley and Central Coast Regions."

Since the curriculum package is not finished, no dissemination of materials has taken place. Once production is complete, we will distribute one copy free of charge to county extension offices and NRCS field offices. Additional copies will be available at cost to other interested parties. We will also enlist resource team members to introduce and encourage use of materials among their colleagues. We plan on holding several in-service education and information workshops to promote the educational packages and intro-

(continued)

duce them to potential audiences. We have already contacted the non-profit Committee for Sustainable Agriculture to arrange a presentation and interactive session on the resource guide at their upcoming 1998 workshops. We will also produce a flyer and information brochure for each package to be mailed out to all interested parties throughout the state. In addition, a press release will be issued and advertising and promotional information will also be accessible through the SAREP and Western Region SARE Program World Wide Web sites.

Potential Benefits

Clearly, having a notebook filled with resources about sustainable soil management in their office will enable CE advisors and NRCS personnel respond to information requests from their clientele. The focus of the resource package is on materials that are directly useful to field personnel in their work with farmers and ranchers. The materials will also serve as a resource for other agricultural professionals who work with extension advisors and NRCS personnel.

Where the resource packages will assist farmers and ranchers in problem solving is somewhat speculative. Although the materials we are collecting are not "cookbook answers" to the myriad of challenges farmers and ranchers face, we believe that increasing knowledge will provide these individuals with ideas that may well lead to solutions. The journal articles and documented research contained in the resource binders have the potential to advance the understanding of sustainable soil management and encourage further experimentation and adaptation of sustainable systems to local conditions.

Impacts on Agricultural Professionals

Since the resource materials are currently under development, no known impacts on agricultural professionals can be measured. However, during the second year of the project, a comprehensive evaluation will collect data on acquisition of new knowledge and changes in attitudes or understanding. The materials will be field tested in a variety of situations that will enable us to collect these data from various sources.

Reactions from Farmers and Ranchers

No training events have taken place to date. Our future plans include demonstrating the resource packages at meetings during 1998, including UC Workgroups and other University meetings as well as non-profit organizations such as the Committee for Sustainable Agriculture. Once these in-service activities have taken place, the evaluator will be collecting information on reactions from end-users (farmers and ranchers) where appropriate.

New Hypotheses / Future Recommendations

No specific changes are recommended. It should be noted, however, that although the participatory nature of this project is essential, it requires a significant commitment of time and resources. Because of this, it is tempting to make unilateral decisions and circumvent the team process to move the work along. This temptation to take shortcuts must be avoided: Each team's direct involvement and buy-in at this phase will strengthen the effectiveness of their role in promoting the materials and supporting others in the field who want to use the guide to provide education on sustainable soil management.

Reported in 1998

Central Coast Team

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Annual Results

Professional Development Program #96-10

Sustainable Arid-Land Grazing Systems: Training for Managers of Public Lands and Reserves

Location:
Northern California

Funding Period:
July 1996 –

Grant Award:
$29,000

Project Coordinator:
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Major Participants:
Public Land Managers and Educational Providers

Objectives

To train participating Extension and natural resource management personnel to be more effective in working cooperatively with range managers and range least-holders to implement sustainable grazing policies and practices on Western region range lands.

Abstract

The overall goal of this educational project is to promote the adoption of sustainable grazing policies and practices on privately-owned ranch lands, public lands and natural reserves hosting grazing enterprises. The education and demonstration site is a field station of the non-profit membership institution, The Bio Integral Resource Center (BIRC). This 60-acre farm integrates dryland grazing of natural colored merino handspinning-wool sheep guarded by donkeys, cashmere goats, laying chickens, weeding geese, agroforestry plantings, a rainwater-capture and water conservation system and a small certified organic vegetable production system, managed as part of the education of nearby community high school students.

Grazing related projects on the farm during the last year included the following: evaluating four commercially available portable electric fence systems, two types of permanent fencing systems and two types of chargers used to control dryland grazing sheep and goats; devising and using a simple computerized record keeping system for numbers of animals grazed per unit of time per site; investigating grazing/physical control weed management strategies for star thistle, turkey mullein, goatgrass and foxtail grasses, cocklebur and horehound (the latter four all producing seeds damaging to the fleeces); and producing, revising and distributing educational materials on these sustainable grazing and other farming techniques.

An investigation was initiated to learn what this project could contribute not duplicative of the many classes and practical educational materials on controlled (management-intensive) grazing now abundantly available through Cooperative Extension and University personnel. Discussions were held with Cooperative Extension agents and University and public agency range ecologists and range managers including representatives from the U.S. Forest Service, BLM, East Bay Regional Parks and others. A library was assembled of manuals, syllabi, hand-outs and layman-oriented how-to magazine and newsletter articles. Computerized searches and a database were started on the related scientific literature, which is extensive.

Some key issues that emerged from discussions with professionals were: pressures from anti-grazing (or anti-animal agriculture) public, needs for better fuel assessment in grazing for fire control and for research on the effects of grazing on plant diversity, conservation of native vegetation and water quality (including the problem of Cryptosporidium contamination). Based on these concerns, a by-invitation planning workshop is scheduled for Spring '98 with range management professionals who provide classes or supervision of controlled (management-intensive) grazing activities on public and private lands. A final workshop will be held in the second week of June which will include results of the yellow star thistle/subclover trials, most visible at that time.

Public education on the critical role played by grazing animals in maintaining grassland diversity may be an important contribution to the further adoption of sustainable grazing. More than 275 adults, (a mix of professionals and general public) 90 college students and 600 school age children (in 21 public school tours) came to learn about sustainable grazing and integrated farm systems at the ranch site in '97. Tours last from 2 to 4 hours and include a short lecture, discussions and handout materials on all aspects of the farm operation. Two video segments showing sustainable grazing, star thistle suppression and other tech-

niques on the Field Station were filmed by KVIE, Sacramento and broadcast to California valley cities on the prime time program "California Heartland."

The overall goal of this educational project is to promote the adoption of sustainable grazing policies and practices on privately-owned ranch lands, public lands and natural reserves hosting lease-held grazing enterprises.

In the initial development of this system we had help from Dave Pratt, Extension Advisor for Yolo and Solano Counties. Pratt helped us establish a "kiwi" fencing system which is the most effective of the electric systems we tested. The sheep graze on pastures of annual grasses and yellow star thistle, green from January to June, then dry until the rains in December. We have assisted Craig Thomsen of the Department of Agronomy and Range Science, University of California at Davis, on the star thistle/ mowing/ subclover trials. Grazing animals are closely integrated into the other systems on the farm.

We revised hand-out materials on grazing, agroforestry and rain-water capture (calculating potential amounts and capture water from ramadas into tanks and ponds

The principle noxious weed at the Field Station is yellow star thistle. We have continued to collaborate with Craig Thomsen. U.C.D. Range Ecologist in his studies on using sheep, sub-clovers and mowing to suppress star thistle (see Attachment A).

However, increasingly we have felt the star thistle on the Field Station offers a benefit to the sheep and this has left us ambivalent about its control. During the summer and fall the dry seedheads are relished by sheep and provide nutrition when little else is left on the pastures. It does not appear to harm the donkeys. We contacted veterinarians at U.C. Davis Veterinary School, Texas A. & M. , and the American Donkey and Mule Society and have not been able to find anyone who knows of a case of donkey pathology where star thistle was implicated.

We have increasingly focused on weeds with seedheads that become a problem because they embed themselves in the wool. These are horehound, Marrubium sp., cocklebur, Xanthium strumarium and various dried grass heads (primarily foxtail barley, Hordeum sp., barb goatgrass, Aegilops sp.). Cocklebur is primarily a problem around the pond and each year's sprouts can be eliminated with a weed whip. Horehound can be handpulled except when it is entwined in fences. The grasses with problem seedheads are bag-mowed when heads dry and before they fall. The seeds are fed to the chickens. A foxtail-suppression experiment, in which a small pasture was over-seeded with lana vetch and oats, was successful in suppressing the foxtail, but not deemed practical for other areas because of the irrigation necessary to start germination in the fall. Lana vetch has been seeded in the pastures and now self propagates.

Two video segments showing sustainable grazing, star thistle suppression and other techniques on the Field Station were filmed by KVIE, Sacramento and broadcast more than once to California valley cities on the prime time program "California Heartland." We also offered tours /field days that stress our experience integrating animal grazing into a small farm system. Although tours drop off during the hottest mid-summer and the cold, rainy mid-winter months, in the past year more than 275 adults (professionals and general public), 90 college students and 600 school age children (in 21 public school tours) came to learn about the sustainable grazing and the small-scale integrated farm here. This is a far larger group than we could have possibly accommodated in a single class or workshop as originally visualized.

Tours last from two to four hours and include an introductory informal lecture, written materials and a slow walk around, with "question and answer" stops to view the sheep, goats, donkeys, geese, rotational grazing pastures, star thistle/subclover trials, agroforestry projects, laying chicken flock, rainwater capture system and student vegetable garden. (The field station has an on-going cooperative project with local high schools to teach producing and selling food.)

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Annual Results

Professional Development Program 96-11

Professional Training in Biologically Integrated Orchard Systems

Location:
California

Funding Period:
July 1996 –

Grant Award:
$77,970

Project Investigator:
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Objectives

This project has three objectives:

1. To develop the capacity of Natural Resources Conservation Service (NRCS), University of California Cooperative Extension (UCCE) personnel and other agricultural professionals to understand and promote successful biologically integrated almond production principles and practices;
2. To develop training for agency personnel and agricultural professionals based on a participatory-learning model and evaluate its suitability for use in other regions;
3. To stimulate hands-on educational events for farmers and other members of the agricultural community to be organized and led by those trained in the mini-courses.

Abstract

In this project, the Community Alliance with Family Farmers (CAFF) is developing curriculum for use in mini-trainings on the methods used in CAFF's Biologically Integrated Orchard Systems (BIOS) program. The BIOS program offers a model for almond and walnut growers to experiment with orchard management systems that allow for reduced reliance on synthetic pesticides. Growers learn to use a variety of biologically-based techniques, which encourage a diverse ecosystem for natural pest and disease control. Over the last four years the BIOS program has successfully helped over 90 growers eliminate or significantly reduce their use of farm chemicals, thereby protecting watersheds from contamination. These techniques will be presented to personnel of the Natural Resource Conservation Service, University of California Cooperative Extension and others to enable them to become advisors for BIOS and other sustainable agriculture projects.

Biologically-based farm management practices include planting and managing a nitrogen-rich cover crop between the tree rows, releasing beneficial insects, spreading compost and monitoring pest and beneficial insect populations. Currently, there are BIOS projects in seven California counties. Each of the local projects is led by a management team made up of experienced growers, independent pest control advisors (PCAs) and University of California Farm Advisors and researchers. One goal of this management team approach is to create a "level playing field" of learning, rather than top-down instruction by experts. The management team leads field days and conducts on-farm visits with participating growers.

The BIOS program was designed as a three-year demonstration project, with the goal of transferring leadership of BIOS activities to local leaders after the duration of CAFF's involvement. Two of CAFF's five BIOS projects have just completed their third season and are engaged in the leadership transition process; the other three projects are entering their final season under CAFF's lead.

With support from SARE, CAFF is now designing a training program based on the BIOS approach to orchard management and technology transfer. This training will be offered to NRCS, UCCE personnel and other agricultural professionals. These professionals will serve as local resources on sustainable agricultural production principles and practices. Moreover, they will also be prepared to carry the orchard management methods promoted by BIOS to a wider audience of growers.

Over the last five months, the Community Alliance with Family Farmers has carefully laid the groundwork for a successful training program on sustainable agriculture practices. This training will be offered to agricultural professionals in the spring and fall of 1998.

In July, CAFF selected a member of the BIOS staff, Mark Cady, to lead this project. Mark coordinated the BIOS projects in Merced and Stanislaus Counties and is now the Transition Coordinator for these two projects as they move on to local institutional coordination. Mark brings to the project his experience

with the BIOS program, as well as the strong, cooperative relationships he has developed with those who will be serving as advisors for the curriculum development.

In addition, CAFF hired a Curriculum Development Coordinator, Jerry Delsol. Jerry is an experienced curriculum developer and agricultural teacher who has written and taught courses at the secondary level in natural resources, agricultural mechanics, ornamental horticulture and agricultural biology. He has also taught agricultural classes at the junior college level.

In August, CAFF developed a list of experienced growers, Pest Control Advisors, Farm Advisors and NRCS staff who have worked with the BIOS program in the past. We sent out a recruitment letter asking people to join the advisory team and got a very positive response. The advisory team met for the first time on October 1, when Jerry Delsol presented a list of possible workshop topics and the team brainstormed additional topics to be included.

The advisory team accepted Jerry's recommendation that two in-depth trainings be developed, each of which will be held twice, in the spring and fall of 1998, for a total of four training sessions. As part of this process the group decided to slightly alter the timeline put forth in the SARE proposal and a revised timeline was sent to the SARE program director at University of California at Davis.

The team discussed options for presenting information in the most effective manner to a diverse audience. The group also drew attention to the importance of understanding the target audiences for the workshop. As we reach out to NRCS and UCCE, we must continue to be aware of the differing institutional cultures of these organizations. It will be a challenge to design and market workshops for both agencies as well as other interested agriculture professionals. The advisory team will meet again in February to finalize the topic list for the spring workshop.

Since this meeting, the Curriculum Developer has conducted Internet searches for Integrated Pest Management for almonds, begun to develop curriculum for the Spring training workshops and interviewed BIOS leaders and participants about specific biological management topics. Topics of interest include evaluating soil quality in BIOS orchards, the BIOS approach to pest and beneficial insect monitoring and utilizing cover crops in an orchard system. Curriculum development for the spring workshops will continue into early 1998.

The BIOS project coordinator has met with the Curriculum Development Coordinator twice a month since August to develop the project workplan, facilitate contacts with the BIOS management team members and participants, to refine potential workshop topics and to review curriculum development progress.

Positive Contributions

We are pleased with the enthusiastic response this project is generating within the circle of growers, PCAs and Farm Advisors who are most active in the BIOS program, and we are confident in our ability to develop high-quality curriculum for agricultural professionals.

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Final Results

SARE #93-34

Four-Corners Navajo Nation Sustainable Agriculture Demonstration Project

Location:
Four-Corners Region of Arizona, Utah, New Mexico and Colorado, Navajo Nation

Funding Period:
September 1993 - February 1997

Grant Award:
$300,000

Project Investigator:
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Major Participants:
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Stephen Poe, Energy & Waste Management Extension Specialist, Utah State University
William Varga, Director, Utah State Botanical Garden, Utah State University
Kathy Williams, Extension Micro-Business Specialist, Colorado State University

(Continued)

Objectives

1. To develop and sustain improved socio-economic conditions for Navajo agro-pastoralist, while maintaining cultural integrity through the preservation of the traditional "Navajo Lifeway."
2. To develop integrated systems to maximize output from Navajo agro-pastoral production practices, while minimizing negative environmental impacts, which include soil, plant, energy, waste management and water quality considerations.
3. To develop a trans-disciplinary whole-farm systems model for sustainable Navajo rural economic development. The process would incorporate a two-way cross-cultural transfer of agro-pastoral technologies.
4. To provide on-site mentoring by a trained Navajo, develop entrepreneurial skills and cultivate leadership proficiency among the Navajo cooperator participants.
5. To establish a Four-Corners Sustainable Agriculture and Natural Resources Advisory Council, made up of participants representing elected officials, federal and state government agencies, Land-Grant Universities, private enterprise and other appropriate organizations representing the States of Arizona, Utah, New Mexico and Colorado and the numerous Native American reservations that encompass the Four-Corners Region.
6. To examine Navajo women's roles in the rural informal sector, their participation in rural markets, the roles of women who head their own households and the efforts of women to minimize economic risk by diversification into wage labor, cash cropping and small businesses on the Navajo Nation.

Abstract

A significant amount of progress was made each year with each of the Navajo SARE cooperators. Early each year of the SARE Project, the joint specialist team reviewed the priorities and barriers as identified by each of the Navajo families in late March or early April at Utah State University. The integrated and diverse team of scientists developed and formulated their annual work plans for each year, from these assessments and priorities as established by the cooperator families. Generally the SARE project implementation plans embraced most of their concerns as they related to sustainable agriculture and pastoralism in the Navajo cultural context. However, many of the barriers identified by the Navajo SARE cooperator families are too difficult to overcome in one year or the brief life of this three-year project. Many of those barriers are institutional both political and social. Yet a close and trusting working relationship between the SARE scientists and each of the Navajo cooperators was an obvious outcome of the entire life of the SARE project. The overall emphasis of this SARE project was to help sustain an agro-pastoral lifestyle by demonstrated practices to help enhance the quality of life of each cooperator and to spread the word by model, participatory exemplary Navajo practitioners and by local field days and educational exhibits. Through the practices and visible accomplishments of the Navajo SARE cooperators, the PI continues to get requests from additional Navajo families that would like to participate by joining our cooperator base. However, due to our limited resources, and non-salary reimbursement structure of the SARE program, and now the short tenure of this particular SARE Four-Corners Project, only two Navajo additional families were taken on in 1995 or 1996.

Due to the extensive and devastating drought in the southwestern U.S. and especially on the Navajo Nation, all livestock producers were hit hard economically in 1996. The PI worked with an editor with the Washington D.C. Times to help solicit funds to assist in the procurement of supplemental feedstuffs for the Navajo Nation pastoralists. Funds were directed to Dine' be' iina (the Navajo Life Way cooperative) that the SARE team cooperates with. Despite the severity of the drought, all SARE cooperator families began a planning calendar with which to manage their sheep and goat flocks. Enhanced life-cycle nutritional feeding was initiated during the winter months, coupled with ad libitum salt/mineral

mixes. Two field-days/workshops for the SARE Navajo families and others of the region were held at the SJBRC with many Navajos in attendance. Grazing habits and performance of goats vs. sheep vs. llamas were evaluated. Guard llamas were placed with the demonstration flock, numbering over 950 head of ewes, lambs, does and kids. No losses during the 1995 season were attributed to predation, while a neighboring Anglo-operated traditional range sheep operation reportedly lost lambs to bears. The animals in the study were negatively impacted near the end of the 1995 season due to a regional outbreak of Vesicular Stomatitis Virus (which did not effect any of our animals) that trapped the grazing project within a quarantine circle. Goats, especially Spanish goats, preferred oakbrush over other woody and non-woody species available, while llamas proved to be an effective biological control against thistle in riparian areas.

In 1994, 1995 and late 1996, homesite analyses were conducted at each of the SARE Navajo cooperator families. Garden and horticultural plant materials were re-introduced as requested. Specific developments and demonstration sites were enhanced by enlarged gardens and utilitarian types of plants near established hogans. The nuclear family and extended family clan/outfit were brought into the planning stages of each of the botanical projects with the SARE families. Functional agricultural plant materials were utilized in all cases. Plants that can be utilized for wool dyeing, basketry, foodstuffs, medicinal and ceremonial purposes are of primary concern to the team.

An economic analysis was conducted with each of the Navajo cooperator families. All the families wished to become more self-sufficient and to generate enough revenue to cover the costs of traditional yet sustainable agro-pastoral practices. One family initiated a value-added wool processing enterprise to their existing operation. A mail order catalog was created, describing various types of raw fleeces, carded roving, traditional Navajo foods, yarns, hand made vertical looms, vegetal wool dye kits, tanned pelts, custom Navajo rugs. Another cooperator family initiated a therapeutic bear-sewing project employing six Navajo women on the cooperator's homesite. A historic stone building was renovated for the development of this business. A cooperator family's daughter, a recent high school graduate, has been receiving business and management training from the SARE team as well as at the College of Eastern Utah-San Juan Campus, Blanding, Utah, so she can oversee entrepreneurship training for these new business ventures. Surplus computers and printers were acquired in year two for each of the Navajo cooperator families and a weekend training workshops were provided. One family, near a highway, is considering establishing a hogan bed and breakfast.

Economic Analysis

Family income is a major concern. Livestock, wool, mohair, vegetables, pelts and handmade products are sold. Anglo-owned chain stores and franchises are a very limited market for traditional Navajo agricultural products. The off-reservation markets and mail order businesses may be the best opportunity for enhanced marketability of Navajo products.

Potential Contributions

The actual development and provision of value-added enterprises to enhance and supplement personal and family financial resources are essential, as are the sense of pride and self-empowerment of becoming exemplary family and farm models by Navajo cooperator families in their respective communities. Ideally, families can move towards emotional solidarity and harmony with traditional culture through the implementation of integrated agro-pastoral practices and involvement and still develop a strong bond of trust with Anglos and a positive attitude towards the universities and programs they represent.

Reported in 1997

Cooperators (Navajo Families):

Joe & Carol Benally, Pinon area, Arizona
Raymond & Lena Benally, Keams Canyon, Arizona
Alta & Sharon Begay, Keams Canyon, Arizona
Irvin & Marjory Curley, Ganado, Arizona
Leo, Sarah and Rebecca Natani, Shiprock, New Mexico
Ruth Watson & Lorena Noelson, Shonto, Arizona
Joan D. Thompson & Ella Delgai, Ganado, Arizona

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Final Results

SARE #94-17

A Comparison of Conventional, Low Input or Organic Farming Systems: Soil Biology, Soil Chemistry, Soil Physics, Energy Utilization, Economics and Risk

Location:
Sacramento Valley, California

Funding Period:
June 1995 - December 1996

Grant Award:
$186,666

Project Investigator:
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Steve Temple, Agronomy
Karen Klonsky, Economics
Frank Zalom, Entomology
Howard Ferris, Nematology
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Ariena Van Bruggen, Plant Pathology
Kate Scow, Soil Microbiology
Willi Horwath, Soil Fertility and Plant Nutrition
Carol Shennan, Soil Fertility and Plant Nutrition
Robert Miller, Soil Fertility and Plant Nutrition
Tom Lanini, Weed Management
Jeff Mitchell, Water Relations
Don Stewart, Staff
Julie McNamara, Information Specialist
Sean Clark, Research Manager

Cooperators:
Bruce Jaffee, Nematology, UC Davis
Don Phillips, Agronomy, UC Davis
Tom Kearney and Gene Miyao, Farm Advisors, Yolo Co.

(Continued)

Objectives

1. Compare four farming systems, with differing levels of dependence on external resources over a twelve year period, with respect to a) abundance and diversity of weed, pathogen, arthropod and nematode populations; b) changes in soil biology, physics, chemistry and water relations; c) crop growth, yield and quality as influenced by different pest management, agronomic and rotational schemes; and d) economic viability.
2. Evaluate existing and/or novel sustainable and organic farming tactics.
3. Distribute and facilitate adoption of information generated by this project to all interested parties as it becomes available.

Abstract

The Sustainable Agriculture Farming Systems (SAFS) project was established to evaluate the biological, agronomic, and economic performance of conventional and alternative farming systems in California's Sacramento Valley. The study consists of four treatment systems which differ primarily in crop rotation and dependence on non-renewable resources. These include a conventional two-year rotation (conv-2) and three different four-year rotations: conventional (conv-4), low-input, and organic. The main crops are tomato, corn, wheat, beans, and safflower. All systems have used "best farmer management practices," determined with the assistance of growers who cooperate on the project. Nitrogen in the organic system is derived from winter legume cover crops and animal manure while that in the low-input system comes from cover crops and supplemental inorganic fertilizer.

Crop yields in the organic system have been comparable to somewhat less than those of the conventional systems. Nitrogen has commonly been the limiting factor in the organic corn and tomato crops due to unpredictable mineralization from cover crops and animal manure. Nitrogen availability in the low-input system has been less problematic because of the limited use of mineral fertilizer. Developing cover crop management strategies to optimize nitrogen availability is an ongoing focus of the project but has been complicated by the influence that cover crops have on insect pest and weed abundance, soil water maintenance, and ultimately, farm operating expenses and profits. Disease, insect, and pathogen pressures have usually not been a significant limitation in any of the systems although there are differences in pest abundance across the treatments. Among these pest classes, weeds have been the most difficult to manage in the organic system because of the absence of herbicides.

Current research efforts are underway in the companion area of the SAFS project to improve the cover crop management practices of the low-input and organic systems for improved nitrogen availability for the following cash crop and more effective weed control. An additional experiment is being used to test the effect of late-summer/fall cultural and cropping practices on levels of bacterial-feeding nematodes in the spring, and to determine the effect of those practices on nitrogen availability to transplanted tomatoes. Research findings from the project are being disseminated through a quarterly newsletter, workshops, and a video, as well as through scientific meetings and publications.

Site Information

The research plots are located on 28 acres of the Agronomy Farm at UC Davis, Yolo County. Prior to the experiment, the acreage had been managed with conventional practices including the use of synthetic pesticides and fertilizers. Because different sections were cropped to alfalfa, vetch and beans, replicates were blocked. The plots are 60 by 220 feet (1/3 of an acre) in order to allow for use of large scale farm machinery for all operations, including planting, disking and harvesting.

Economic Analysis

In 1996 total costs for the four farming systems ranged from $694 to $903 per acre. The low-input system was the lowest cost system at $694 per acre. It was followed by conv-4 at $726, conv-2 at $807 and organic at $903 per acre. Surprisingly, the low-input system was also the most profitable among the systems this year returning $196 per acre. Its profits were closely followed by the organic receiving premium prices at $193, conv-4 with $186, and $171 for conv-2 per acre. The organic receiving conventional prices had a net loss of $109 per acre. Replanting conventional tomatoes led to higher costs in both of those systems. The other major sources of cost differences were weed control practices, use of cover crops in the organic and low-input systems, and the addition of manure in the organic tomatoes and corn.

Jim Durst, Farmer, Esparto, CA
Bruce Rominger, Farmer, Winters,CA
Ed Sills, Farmer, Pleasant Grove, CA
Tony Turkovich, Farmer, Winters, CA

Potential Contributions

Cover Crop Management: Specific data has been collected for production of cover crops for green manure, green chop, and seed harvest. Two winter, companion-area experiments have shown a number of species, grown individually or in mixtures, to be successful in the Sacramento Valley. Oat/vetch, barley/vetch and faba/pea were all economically viable and showed only slight yield reductions under reduced tillage. If implemented, reduced tillage management could increase energy savings and increase profit. Results from these cover crop studies could be very useful and practical for growers needing information about specific cover crops under a various climatic and management conditions. Current research in the companion area is being conducted to evaluate other cover crops for use in this area.

Low Input Management: The low input system is emerging as a very strong alternative to conventionally managed systems. Yields are consistently competitive in the corn and tomatoes. The success of this management system clearly shows that a combination of cover crop and mineral supplement not only provides sufficient N, but that the cover crop has tangible values beyond fertilizer N. The economic success of the low input corn makes it a strong contender for widespread application. Four years of results indicate that mineral fertilizer in corn can be reduced by 50 percent when adequate nitrogen is supplied from a cover crop. Furthermore pesticide use (herbicides and insecticides) in the low-input corn system over the eight years of this study has been only 25 percent of that in the conventional system.

Benefits of Tissue Tests in Corn: Tissue tests at key growth stages in corn have been very useful in identifying N deficiency in the organic corn system and alerting us to a production and N efficiency problem in the conventional system.

Disease Suppression: Corky root and knobby root have been more severe under conventional management, particularly in the two-year rotation. This indicates that the four-year rotation has contributes to disease suppression and that the organic amendments added to the organic and low-input systems through cover cropping and manure applications may suppress soil-borne pathogens.

Soil Physical Characteristics: Although most traditional agronomic experiments are much shorter than the SAFS project, we believe that even eight years is a very short time for certain differences to emerge. It has taken seven years to see negative impacts of the two year rotation as well as the positive effects on soil tilth in the low-input and organic system. Long-term positive benefits such as substantial increases in organic matter contributing to improved soil aggregation or water infiltration are becoming clearer with each season and warrant further exploration. We expect that new benefits will be continually identified as time passes.

Farmer Adoption

Changes observed and reported through verbal communication include greater interest in cover crops, legumes and crop rotations; increased organic acreage in field crops; increased monitoring by growers of water use/efficiency, pest thresholds and soil and crop nitrogen requirements; and heightened interest in a more holistic view of soil health. Agricultural equipment dealers have also begun demonstrating more of an interest in specialized equipment, specifically for tillage and non-chemical weed management. As the project has matured, there is widespread consensus that we have been able to demonstrate to the tomato industry that organic production is biologically possible and economically viable at premium market prices.

Because farmers are such a heterogeneous group and manage their farms in their own unique styles, it would be difficult to assess how many growers have actually used specific project results for their own operations. However, as interest in sustainable agriculture grows, the project has come to serve as an information base for growers and farm advisors in the area looking for either specific or theoretical information.

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Final Results

ACE #93-12

Range Monitoring in the Upper Stony Creek Watershed

Location:
Glenn and Colusa Counties

Funding Period:
September 1993 - December 1996

Grant Award:
$40,000

Project Investigator:
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Project Assistants:
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Steve Mora (1995, 996)

Major Participants:
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Wendell Gilgert, District Conservationist, Glenn County
Alan Forkey, District Conservationist, Colusa County
Dennis Nay, Range Conservationist, Glenn County

Cooperators:
Jeff Sommerville, 4J Ranch, Elk Creek, CA
Russell King, King Ranch, Baldwin, CA
Bill Dierks (Deceased), leased grazing on King Ranch.
Glenn Nader, Livestock/ Natural Resource Advisor, UCCE Yuba/Sutter Counties
Mike DeLasaux, Natural Resource Advisor, UCCE Plumas- Sierra Counties

(Continued)

Objectives

1. Document the effect of grazing systems and resulting stocking densities on annual rangeland ecology by monitoring changes over time in ground cover, canopy cover, soil bulk density, target plant density, residual dry matter, grazing intensity, infiltration rates and interrill erosion.
2. Determine the impact of grazing systems and resulting stocking densities on the riparian profile and vegetation by monitoring changes over time in streambank vegetation density and canopy cover with elevation transects of riparian above and below check dams. This detailed monitoring will provide data on the impacts of land management practices in the watershed which will validate or indicate the inadequacies of a simpler level of monitoring. The second level of monitoring is in fact simple, practical and economical so that landowners can take on the task of monitoring their own rangeland.
3. To develop, demonstrate and achieve rancher adoption of procedures by which they can and will monitor progress or lack of progress toward meeting their production and landscape goals.

Abstract of Results

The Glenn and Colusa Resource Conservation Districts initiated a major PL-566 project involving an entire watershed on private lands. Objectives of the project were to be met by individual ranch practices such as controlled grazing, brush management, stock water development and riparian check dam construction. To date $527,000 has been paid out to landowners for cost sharing on approved practices. Unfortunately, no specific funding for monitoring was included in the PL-566 watershed project.

This SARE/ACE grant encompassed two levels of monitoring within the watershed. The first level of monitoring was detailed, annual and designed for statistical analysis. While this level of monitoring was not able to detect significant change due to grazing regimes in the watershed, it did provide valuable information and experience for evaluating monitoring methods and establishing a simpler monitoring method. The second level of monitoring was developed to be simple, practical and economical so that landowners can take on the task of monitoring their own rangeland. In cooperation with seven other University of California Cooperative Extension Advisors a "hands-on" handbook on how to monitor rangeland-Level 1 was developed. Level 1 instructs landowners on how to monitor range sites with a camera. Our experience with the Upper Stony Creek Watershed Project provided guidance for evaluating text and creating illustrations for Level 1. With funding support from the California Cattlemen's Association, a 12-minute video was developed based on the How to Monitor Handbook to encourage and demonstrate photo monitoring. Nineteen landowners in the Upper Stony Creek Watershed were provided the How to Monitor Handbook and a disposable camera. They were also assisted in established permanent photo monitoring points. Landowners in the watershed also attended a 5-day short-course on ranch planning and monitoring.

The significance of developing the How to Monitor Handbook has been demonstrated by the overwhelming response. To date over 400 manuals and 80 videotapes have been distributed throughout California, the western United States, Canada and Australia. In addition to providing University of California extension advisors and Natural Resource Conservation District Personnel with monitoring curriculum, several other states are interested in using the information presented in How to Monitor. The handbook and videos have been used in teaching curriculum at Oregon State University. The handbook was also used in a course outline for the University of South Dakota's satellite cow/calf operator program.

How to Monitor- Level II was developed to instruct on more specific monitoring methods for collecting data on vegetation cover, utilization, residual dry matter, water quality and wildlife. Monitoring methodology on vegetation cover for the Level II handbook was developed and field tested in conjunction with

the Upper Stony Creek Watershed Project. In addition, information for a riparian profile monitoring study in this project was developed into a case study for the How to Monitor Handbook- Level II. How to Monitor- Level II is currently being published and will be ready for distribution in January 1997. There are already numerous requests throughout the western United States for this publication.

Rick Delmas, Livestock/ Natural Resource Advisor, UCCE Modoc County
Dan Drake, Livestock Advisor, UCCE Siskiyou County
Larry Forero, Livestock/ Natural Resource Advisor, UCCE Shasta County
Holly George, Livestock/ Range Advisor, UCCE Plumas- Sierra Counties
Rhonda Gildersleeve, County Director/ Farm Advisor, UCCE Inyo-Mono Counties

Site Information

The Upper Stony Creek Watershed is located about 120 miles north of San Francisco on the eastern side of California's Inner Coast Range within Glenn and Colusa Counties. The watershed averages about 25 miles in length and 15 miles in width. It includes approximately 243,200 acres. Over half of the watershed is part of the Mendocino National Forest. About one-third of the watershed is in private ownership (75,300 acres), most of which is located in the eastern part of the watershed. The land in private land ownership was the target of the PL-566 project and this monitoring project.

Dissemination of Findings

The significance of developing the How to Monitor Handbook has been demonstrated by the overwhelming response. How to Monitor- Level 1 was advertised quickly by word-of-mouth and with articles in the following publications: National Cattlemen's Magazine, California Cattlemen's Magazine, California Farmer, Beef Today, Society of Range Management-Trail Boss, Farm Bureau-Ag Alert and Pasture Notes. The advertisement also was distributed via electronic mail on GrazeL, a network list of those interested in grazing management. To date over 400 manuals and 80 videotapes have been distributed throughout California, the western United States, Canada and Australia. The video-Level 1 was used in April 1995 as part of a national telecast of the Nebraska Cattlemen's Land Stewardship Short-Course.

In addition to providing University of California extension advisors and Natural Resource Conservation District Personnel with monitoring curriculum, several other states are interested in using the information presented in How to Monitor. The handbook and videos have been used in teaching curriculum at Oregon State University. The handbook was also used a course outline for the University of South Dakota's satellite cow/calf operator program.

Potential Contributions

In recent years, ranchers have been encouraged agency and university personnel to monitor conditions on their private and public rangelands. Concerns about the impact of livestock grazing on Endangered Species and water quality have lead to field discussions that are based on little or no data regarding vegetation and wildlife trends on grazed lands. In addition, public funding to provide cost sharing for range improvement practice like those promoted by the PL-566 Upper Stony Creek Watershed Project have been doled out with no "on the ground" monitoring set in place to determine if the practices are effective. Today many rancher understand and appreciate the need for rangeland monitoring, but feel it is a complex process. Since prior to developing How to Monitor–Level 1, no simplified, complete "hands on" manual existed on monitoring, ranchers were reluctant to implement a monitoring program on their range sites.

Our efforts and experience in the Upper Stony Creek Watershed Monitoring Project were instrumental in the development of the How to Monitor Handbook- Level 1 and Level II and two videos illustrating monitoring techniques.

Producer Adoption

Twenty-five landowners have participated in cost-share plans for land treatment practices in this watershed. Through the Upper Stony Creek Watershed Monitoring Project 19 landowners have been provided with information, materials and assistance in developing a monitoring program on their ranch.

Our detailed monitoring activities in the watershed resulted in changing the monitoring method being promoted for vegetation cover to a method that was more effective and more likely to be adopted by landowners.

The distribution of over 400 How to Monitor Handbooks throughout the western United States and Internationally will help many other ranchers and landowners begin monitoring programs on their range sites.

Reported in 1997

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Final Results

ACE #95-102

Cattle Grazing Dispersion Methods And Riparian Ecosystems

Location:
Oregon and Idaho

Grant Award:
$42,070

Funding Period:
July 1995–June 1997

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John A. Tanaka, Dept. of Agricultural and Resource Economics, Oregon State University

Cooperators:
Larry Hartman, Blue Mountains Natural Resources Institute, USDA, Forest Service
Sharon Beck, Oregon Cattle Association

(Continued)

Objectives

1. Determine the impacts of cattle dispersion methods for relieving grazing stresses on riparian ecosystems.
2. Determine the economic feasibility of cattle dispersion methods.
3. Demonstrate riparian area and cattle dispersion management practices in a visibly comparative field trial.

Abstract

A two-year grazing study evaluating the effects of cattle dispersion methods on riparian ecosystems was completed. Cattle grazing and "riparian health" issues are currently at the forefront of public and rancher concerns in the Northwest. A ballot initiative in Oregon proposed that cattle be fenced out of all riparian areas located in critical habitat stream segments. In southwest Idaho, the current BLM Resource Management Plan proposes a 35 percent reduction in animal unit months that would eliminate cattle grazing in those allotments after July 15 to reduce the impacts of cattle grazing on riparian areas. Research findings and the demonstrative value of this study are timely and extremely important to ranchers, as well as recreationalists, environmentalists and agency personnel. The critical need for this type of project is evidenced by the number of stakeholders that have become cooperators. Clientele interest has been high, especially concerning the ram pump water system and the use of GPS as it relates to cattle behavior and site mapping.

Site construction, forage evaluation, riparian, transitional zone and upland bio-assessment, water quality analysis, cattle performance and behavior, site mapping, economic analyses, and two field days have been completed. The treatments consisted of grazing with alternative water and supplementation (trace mineral salt) sources, grazing with no alternative water or supplementation and no grazing. Each treatment was replicated three times for a total of nine pastures that provided visual across-fence comparisons. The study was replicated over two years. The project was designed to evaluate the economic impacts of developing off-stream water on ranches in the Pacific Northwest. The ACE grant (a portion of the project was funded through SARE/ACE) and matching state dollars provided funding for the first year. State funds and contributions from the Blue Mountains Natural Resources Institute were used to complete the second year.

Cattle behavior and distribution, cow/calf performance, forage utilization, riparian bio- assessments and greenline were affected by treatments. Off-stream water and salt more evenly distributed cattle in each pasture throughout the grazing season. Providing off-stream water eliminated the requirement for cattle to return to the riparian area at mid-day where cattle drank and then spent several hours "loafing" (resting). Economic analyses indicate that the off-stream water development was profitable, with initial costs and maintenance off set by improved cow/calf performance, reduced grazing pressure on riparian forage and likelihood of meeting environmental goals.

Cross-fencing, working facilities, alternative water and supplementation sources were constructed. Aerial photography and Global Positioning Systems (GPS) analysis were completed for mapping and "ground truthing" purposes. These maps were used to aid in monitoring cattle behavior, establishing vegetative species distribution and canopy cover, identify riparian, transitional and upland boundaries and determine other topographical attributes of the research site that could affect cattle distribution.

Economic Analysis

The economic analysis of this project contained three stages. The first was to discover the current economic circumstances of ranchers. This information formed the foundation for the second stage in which the economic feasibility of the project was determined. The results from the feasibility analysis were then used in the third stage to formulate policy implications and recommendations.

Implementation of the dispersion method will directly impact ranchers' budgets through the initial expense of equipment purchases and increased operating costs. A developed comparison among different water systems (such as solar powered pumps, water rams and transporting water) provides ranchers with the necessary data to determine which system best fits their needs. Preliminary animal performance data, which indicate average daily gains are increased through the dispersion method, translates into additional income for the ranches. An economic feasibility document was produced showing ranchers when the system will pay for itself.

To evaluate the policy implications of the project, a dynamic program was constructed that models a 300-head cow/calf operation. Using a long-term planning horizon, it shows the changes in profitability of the ranch when various scenarios are introduced. For example, how do net returns change when the water dispersion project is implemented and the riparian area is excluded from cattle? This will be an important tool for management of riparian areas in livestock operations.

Potential Contributions

While the benefits from the research side of the project are not yet realized, the project has generated enthusiasm among the various clientele groups that have concerns over cattle grazing in riparian areas. The startup money provided by SARE/ACE led to other funding sources and a commitment by the Universities to undertake this effort. A "snowball" effect has occurred, with commodity groups and individuals becoming involved after they recognized the benefits of this cooperative project. With new stakeholder groups participating, the pathways for disseminating information from this study have increased.

Farmer Adoption and Direct Impact

Before management practices that affect livestock production and environmental sustainability are incorporated into ranch systems, the economic analysis can now be assessed to determine feasibility. Extension programs are in place to demonstrate the results of the project, and requests for detailed information from the project are numerous. Comments from the clientele groups indicate that multi-disciplinary projects like this are critical to continued wise use of our natural resources.

Requests for this type of information indicate that ranchers as well as agency personnel are extremely interested in incorporating results from this study into their resource management plans. Funding is available for watershed programs on private and public lands and this information creates the framework to model where improvements will be beneficial and cost effective. Those ranchers with water systems already in place are using this information to validate their investments.

Ranchers have indicated that this is the type of project we should have been doing all along. They appreciate the group effort and rancher involvement. The combination of research and extension working together with various interest groups will avoid problems when it comes time to incorporate results into ranch management plans.

New Hypotheses

Along with off-stream watering and supplementation, topographical and biological elements must be factored into cattle behavior and the impacts of cattle grazing on riparian ecosystems. Through the use of Global Positioning Systems, aerial photography and intensive pasture data collections, much of this data has been collected and will be incorporated into a whole ranch system model along with an economic analysis. This approach will improve our ability to effectively disseminate the information, and better ensure assimilation of beneficial grazing practices into western ranches.

Dissemination of information through field days, popular press articles and stakeholder meetings has been ongoing and requests for summary information are numerous.

Reported in 1998

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Patty Perry, Grand Ronde Model Watershed, La Grande, Oregon
John Williams, Natural Resources Extension Agent, Oregon State University
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Jay Carr, Natural Resources Extension Agent, Oregon State University
Sara Braasch, Idaho Cattle Association
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Margaret Soulen, Idaho Rangeland Resource Commission, Boise, Idaho
Gordon Keetch, Extension Educator, Adams County Coop. Extension System, Council, Idaho
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Final Results

ACE #95-202

Development and Demonstration of a Farm-Wide System for Control of the Principal Lepidopterous Pests of Tomatoes Based on Disruption of Premating-Pheramone Communication Between Female and Male Moths

Location:
California

Funding Period:
July 1995 - December 1996

Grant Award:
$40,000

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Objectives

1. Demonstrate the efficacy of a novel system for distributing synthetic pheromone components into the air over large acreages of whole tomato ranches, for disruption of pre-mating pheromone communication of each of the principal lepidopterous pests of this crop.
2. Determine the minimum size acreage of tomatoes (and adjoining crops) that must be treated by the use of this system, in order to prevent significant numbers of already-mated female moths from entering the pheromone-treated areas from neighboring untreated areas and avoiding the pheromone communication disruption.
3. Calculate the benefits derived from controlling the major lepidopterous pests of tomatoes by this pheromone-communication-disruption system, including reductions in the use of conventional pesticides, preservation of natural enemies in pheromone-treated fields, and reduction in outbreaks of secondary pests of tomatoes.
4. Organize outreach activities that will ensure that this emerging technology is understood by and available to tomato growers, as well as PCAs, regulatory personnel, farm advisors, and other affected personnel.

Abstract

Puffers are novel devices for dispensing pheromones into the air of agricultural fields to disrupt communication and thus eliminate mating of pest moth species. These machines release repeated puffs of pheromone from pressurized aerosol cans, with individual puffs often containing pheromone equivalent to millions of female moths. They have a number of advantages, in comparison to traditional, hand-applied, pheromone-release devices. Because the pheromone is protected from light and oxygen until the moment of release, chemical breakdown is minimized. Two or more pheromones can be mixed and emitted together, giving the opportunity for simultaneous control of more than one species.

The amount of pheromone released is the same for the last puff as it was for the first puff released from a can, giving a predictable amount of pheromone delivered per unit of time. Labor costs for installing puffers are apt to be considerably lower than they are for hand-applied devices. In a number of season-long trials in tomatoes, puffers showed high potential for controlling multiple pest species — beet armyworms, tomato fruitworms, and tomato pinworms — on a wide area, farm-wide basis. The work indicates that for each species about 20 g of the respective pheromone per acre per 100-day season will be needed to provide economic control of the pests.

The beet armyworm, tomato fruitworm and tomato pinworm are major pests of both fresh-market and processing tomatoes in California. A weak point in the life cycle of all three species is the necessity for the two sexes to come together, with the male being guided to the vicinity of the female by the pheromone odor that she emits when she is ready for mating. We have determined for a number of moth species that if the male can not sense and use the pheromone odor for guidance, he can not locate female moths, which will remain unmated. A method for mating control, which we and other investigators have been researching for various lepidopterous pests, is based on permeation of the atmosphere with the pheromone odor (the pheromones for each of the three pests addressed here have been identified and are purchased through chemical specialty companies). With the odor of receptive females now being everywhere, the males can not find the real females, and they remain unmated.

The tomato pinworm pheromone has already been developed for commercial use in California tomato fields. The tomato pinworm is a very small, weak-flying moth. We think that the early success of communication-disruption programs for this species was aided by the fact that most of the male and female moths probably reside and find each other in the same 40-acre block of tomatoes in which they grew up as

larvae. A very restricted movement of mated female moths probably prevents much re-infestation from surrounding tomato fields that are outside pheromone-treated areas. In contrast, the beet armyworm and tomato fruitworm moths are large, robust fliers, and it is obvious that the area through which mated female moths of these species range may well be over a radius of a half mile. This fact indicates that for these species a pheromone-treated area may have to be as large as 160 to 640 acres, or even more, in order to effectively prevent re-infestation by females that mate outside of pheromone-treated areas and then invade the treated areas.

Until recently, application technology has been a limitation to our ability to treat very large areas efficiently and economically. The problems were compounded because the beet armyworm and tomato fruitworm pheromones are quite unstable, breaking down to inactive compounds when exposed to air in conventional pheromone-release devices. Also, application of conventional pheromone-release devices may be very costly. These are machines for the dispensing of puffs of moth pheromones at predetermined time intervals from pressurized aerosol cans. In our earlier research, we found that deployment of only one puffer for every two to ten acres may be adequate for control of mating of the beet armyworm.

Because of early scheduling and quality-control problems that we encountered in contracting with the aerosol-can-filling industry to custom-fill small numbers of cans with experimental pheromone and propellant blends, we developed our own filling facility at the UC Kearney Agricultural Center in Parlier. This facility, which has state-of-the-art commercial-scale equipment, is, to our knowledge, the only such facility in a university laboratory in the United States.

Experiment with "Shinetsu Ropes," 1996, One of the most successful conventional (hand-applied) pheromone formulations utilizes the Shinetsu Rope, a length of hollow polyethyene tubing filled with pheromone. The rope is wrapped around a plant stem or leaf petiole in the same manner as a twist'em tie." Shinetsu ropes loaded with beet and armyworm pheromone were received from the manufacturer and hand attached to the foliage of tomato plants in a rectangular 150-acre field in late August 1996. This gave an application rate of about 100 ropes per acre. The Shinetsu rope formulation gave essentially complete disruption of beet armyworm moth pheromone communication for up to two months after application, but the strong flight behavior of the moths probably brought enough mated female moths into a single protected field that the method may not give adequate worm control unless larger areas can be treated.

Out-reach activities have been emphasized during this research. During the 1995 and 1996 seasons, the project has been demonstrated and discussed at eight meetings for growers, pest control advisors, scientists, and regulatory personnel, with a total audience of over 400 persons.

Economic Analysis

This research has not proceeded to the level that permits the calculation of cost-benefits. With the continued support of the California tomato industry, a series of culminating experiments is planned for 1997, including analysis of the economic benefits derived from bringing the major pests of tomatoes under suppression through disruption of their pheromone communication.

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Final Results

ACE #95-203

Non-Chemical Control of Bollworm and Pink Bollworm in Cotton and Automated Insect, Plant and Profit Analysis

Location:
New Mexico

Funding Period:
July 1995 - December 1996

Grant Award:
$40,000

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Cooperator:
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Objectives

1. To integrate and test non-chemical insect control factors for cotton insect control.
2. Furnish growers with a immediate management information which can be used to predict future events.
3. To furnish ecological data which can be used to expand our understanding of community structure and function within the economic structure and time dictated by crop production

Abstract

The broad objective of this research was to test a portable pest management system which can be quickly integrate biological attributes of relevant plant and animal species in extensive agricultural ecosystems over large land masses. An overview of the important features of crop production (fertilizer, soil, moisture, pesticides, weather, plant phenology, migration, distribution and parasite/predator interactions) in relation to arthropod population dynamics in both relatively simple and complex agricultural ecosystems, can be obtained. This system offers a new approach to the management of pest populations.

Computer Vision software has been developed that is capable of classifying a variety of pests and beneficial insects from digital images of field samples. The software currently performs with an approximate average error rate of 12 percent in an open-world sense (actual operating conditions) and 0.5 percent in a closed-world sense but improvement is expected with careful selection and evaluation of new feature measurements. This software can greatly enhance the efficiency of field scouts, researchers and growers in making rapid management decisions.

Our research to reduce hard, environmentally less friendly insecticides involved testing four insecticides on Acala 1517-91 cotton to evaluate the toxicity on the beneficial complex. The insecticides used were Tracer, a biological insecticide, Regent, a new class of insecticides, Confirm, an ecdysome-mimic insect growth regulator, and Karate, used as a standard. Confirm, Regent, Tracer did not reduce the total density of the beneficial complex in cotton. Confirm was the softest insecticide on the beneficial complex. Tracer at higher dosages showed some efficacy on parasitoids. Nabids were sensitive to all treatments; however assassin bugs and collops beetles seemed to be unaffected by all treatments. Karate significantly reduced the density of 10 species of beneficials and promoted secondary outbreaks of cotton aphids.

Early season control of pink bollworm (PBW) with pheromones was demonstrated on 35 acres of upland cotton that in previous years had 40 to 75 percent infestation. Plant phenology was monitored weekly to evaluate the stage of the plant that was most susceptible to early season pink boll worm infestations. Emergence of PBW prior to first square are suicidal and reducing overwintering emergence with pheromones limited the initial early season infestations allowing fruiting structures to mature. Mature bolls are less attractive to PBW infestation. Eliminating insecticides early season also maintained a balance of beneficial insects, keeping secondary pests in check. Pheromone applications prior to first square decreased infestation to less than 4 percent. Late in the season (September) pheromone applications were less effective when higher densities of pink bollworm existed. Timing of one or two late season applications of insecticides reduced repeated insecticide applications and increased yield. Cotton that received only one (timed) application of insecticide with no early season pheromone and early termination with defoliant averaged 8 percent PBW infestation. Cotton left untreated (receiving only a defoliant for termination) averaged 35 to 45 percent PBW infestation. Cotton receiving repeated applications of insecticide sustained 8 percent PBW infestation but caused secondary aphid outbreaks which required additional treatments.

Timing of planting and harvesting plays a major role in the ability of pink bollworms to overwinter successfully. Cotton planted early and harvested late provides the best scenario for increased overwintering development. To determine which times are optimal for planting and termination of cotton pink bollworm larvae were collected from cotton bolls weekly late season and retained in cups and maintained at a constant temperature. Those that remained as larvae at the end of the season were considered to be in diapause and those that emerged as adults moths were not. Date of emergence, variety of cotton and sex of larvae were recorded. Adult PBW begin emerging around mid April, this population is suicidal until squares are available. Delayed planting delays squaring but not significantly. Delaying the first irrigation also aids in delaying squaring. This enhances the suicidal emergence of PBW. Moths begin an early diapause about mid-September, peaking mid to late October and diminishing in early November. Those moths that entered diapause in October were successful in completing development the following year when squares were present. Those that entered diapause earlier and later than that period were less successful, mostly the suicidal population. Maturing and terminating the cotton crop in early October could significantly reduce the overwintering population in successive years. Integrated with a pheromone program, PBW could be managed to reduce cost and environmental hazards.

Cotton interplanted with four varieties of refugia to maintain a reservoir of beneficial insects was evaluated. Refugia were alfalfa, canola, sanfoin and hairy vetch. Samples were taken frequently to evaluate the density of beneficial insects in the refugia. Sanfoin and canola had the highest density of beneficial insects. The refugia attracted parasitoids, some of which could be effective in controlling pink bollworm and bollworm. The hymenoptera families with the highest densities were: Mymaridae, Braconidae, Eulophidae and Pteromalidae. The more abundant groups of predators were Nabis spp, Geocoris spp, Orius spp, Collops spp and Coccinelids. The refugia planted next to cotton acted more as a sink for beneficial insects and may require additional management such as timely mowing to promote migration from the refugia to the cotton.

Two types of PBW pheromone traps (standard delta trap and oil trap) were evaluated for efficiency and effectiveness for use as a management decision making tool. Although trap catches cannot be correlated to infestation in the field, trap catches do characterize initiation and duration of effectiveness of pheromone applications.

Bt cotton plants were transplanted (six true leaf stage) into blocks of newly seeded upland cotton (20%:80%, respectively) to provide an attractive food source for overwintering PBW and bollworm. Our results with transgenic Bt cotton showed that cotton transplants did not impact PBW and bollworm infestations significantly. Damage to upland 1517 was apparent (8% to 24%), whereas the Bt cotton sustained incomplete infestation (penetration of larvae halted at the carpel wall, where mortality of first instar larvae occurred). Although there was some level of PBW and bollworm mortality, the effect of the interplanted crop on the general population was limited.

A pamphlet relating present and past results will be distributed to growers at local meetings by extension agents. This pamphlet will detail management strategies growers can use for pink bollworm and bollworm control in IPM systems.

Submitted to the Journal of Cotton Science: "Comparison of two pheromone traps, delta sticky trap and high capacity oil, for effectiveness and sensitivity in captures of pink bollworm Pectinophora gossypiella, (Sanders)"

Economic Analysis

Approximately 20,000 acres of cotton are grown in and around the Mesilla Valley. An average "hard" insecticide application may range from $12.00 to $15.00 per acre, excluding any long term health and environmental cost. A rigid non-chemical control program can save growers three to four applications of insecticides ($36.00 to $60.00/acre). Early season pheromone and "soft" insecticide applications minimize the impact of hard insecticide applications further reducing health and environmental risks.

Farmer Adoption and Direct Impact

Organic growers and progressive growers have adopted and implemented some IPM practices. Pink bollworm and bollworm control are expected to be confounded by a region wide boll weevil (BW) eradication program being proposed for this area. Incorporation of some of these results may be imperative for a successful eradication program. The eradication program as presently envisioned will involved intense repeated applications of insecticides. Providing growers with alternative methods of PBW control will substantially minimize insecticide applications, enhancing chances for total eradication.

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Final Results

Professional Development Program #94-03

Multidisciplinary On-Site Training in Sustainable Agriculture

Location:
Sacramento Valley

Funding Period:
July 1994 - September 1997

Grant Award:
$71,000

Project Coordinators:
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Kate Scow, Department of Land, Air and Water Resources
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Steve Temple, Agronomy Extension

(Continued)

Objectives

1. Develop multidisciplinary workshops on sustainable agriculture practices to train Farm Advisors, other extension personnel, USDA-NRCS field officers and PCAs using the SAFS project as a "living laboratory."
2. Develop educational materials on sustainable agriculture for workshop participants that can be used by Farm Advisors, USDA-NRCS field officers, other extension personnel and PCAs as educational tools.
3. Develop outreach and educational programs to disseminate information from results of the first eight years of the SAFS project to Farm Advisors, USDA-NRCS field officers, other agricultural professionals as information becomes available.

Abstract

In addition to three annual field days, the Professional development component of the SAFS project has conducted a series of six intensive workshops from 1995 to 1997, in which close to 500 agricultural professionals received in-service training. These participants included representatives from Extension, USDA-NRCS and various university and government sectors. Since the SAFS project is a research-based project, it functions as both a demonstration trial and a living laboratory for workshop participants. Due to the "real-world" applicability of the SAFS project, the Principal Investigators are highly motivated to participate in workshops and field days, where they can interact and exchange information with trainees. Accordingly, the workshops and field days serve not only as a resource for new information and materials, but perhaps more importantly, as training in research methodology for sustainable agriculture issues.

Educational materials were distributed at all workshops, which included several research publications, various tables and graphs, resource lists for alternative management methods, fertility management tools and methods.

Two annual summer field days were held, each attended by over 125 participants. These included growers, farm advisors, international visitors and scholars as well as students from throughout the state. These field days consisted of a field tour, update of recent findings and several laboratory demonstrations. In 1996 an Agricultural Technology section was added to the field day.

Two different slide shows were produced in 1995. One was an overview of the project, including the goals, methods and experimental design, with general agronomic and economic results generated by the first eight years. The other was produced for the SAFS Principal Investigators to help in presentations at academic and industry meetings. These shows were continuously updated throughout 1996 and 1997 as new information from the project emerged. Extensive sections on fertility, soil biology and pest management were added in 1996 and 1997.

A video of the SAFS project was completed January 1, 1997. This includes an overview of the project, the experimental design, the participatory research process as well as all current findings.

A Web page for the SAFS project is posted at http://agronomy.ucdavis.edu/safs/home.htm. This includes the project description, experimental design, publications and abstracts and current education and outreach events. Several other URL links are posted on the page, providing a gateway to over 25 other Sustainable Agriculture websites.

A quarterly SAFS Bulletin of Research Findings is distributed to the target audience, as well the SAFS mailing list of over 1500 agricultural professionals statewide. Distribution occurs regionally and internationally, through postings on the SAFS Web page and the SANET network.

To advertise the workshops and field days, flyers, personal letters of invitation and posters were distributed by mail and FAX to several hundred potential participants. Workshop participants were solicited from regional, state and county Cooperative Extension and USDA/NRCS field offices throughout the state, as well as from state coordinators of the Western Region SARE grants. All forms of electronic media such as SANET, SAED-SHARE, WSARE, other bulletin boards and the SAFS Web page were also used to advertise the workshops. Additionally, press releases were sent out to over 200 regional and ag industry publications to advertise the annual field day.

The field days are particularly exciting events, bringing growers, students, visiting scholars as well as members from the PDP target audience to the project. With a mailing list of over 1500 members, the project has gained visibility throughout the Western Region.

Potential Benefits or Impacts

Workshop and field day participants gained exposure to the methods and results of the project and had the opportunity to interact with the researchers, Farm Advisors and growers on the SAFS project team. In the workshops, participants were instructed in field sampling and lab analysis methods to evaluate soil health and quality, weed population dynamics, general fertility guidelines and cover crop management.

The SAFS workshops have been continually improved upon, in response to evaluations and exchanged ideas among the SAFS team. Consequently, the attendance at each workshop and field day has also improved steadily. Each workshop has had a focused theme, which was explored in depth by the researchers within that particular discipline. Although the target audience is broad and diverse in its scope, we feel that we have satisfied the needs and interests of most of our participants.

In California, the University of California Cooperative Extension (UCCE) Farm Advisors are highly educated specialists. Their skill level, combined with their active involvement in research, makes it both necessary and possible to offer these training sessions at a very sophisticated, graduate level. Since the SAFS project is a research-based project, it functions as both a demonstration trial and a living laboratory for workshop participants. Due to the "real-world" applicability of the SAFS project, the Principal Investigators are highly motivated to participate in these workshops where they can interact and exchange information with the UCCE and NRCS participants. Accordingly, the workshops serve not only as a resource for information and materials, but perhaps more importantly, as training in research methodology for sustainable agriculture systems. Therefore, the training would ideally lead to exponential growth in sustainable agricultural research, as the participants familiarize themselves with the SAFS researchers and utilize these newly acquired skills in their own cropping systems and diverse geographical areas throughout the Western Region.

Impacts on Agricultural Professionals

Most participants responded enthusiastically to the methodology used and the results generated by the SAFS project. The evaluations showed that they also responded positively to the sampling and evaluation methods taught in the workshops, as well as the education packets provided.

New Hypotheses and Future Recommendations

We are finding that after nine years of operation, as a collectively operated multidisciplinary project, far more information and expertise has been generated than expected, and the current resources do not enable information to be shared at the level we would like. While our information dissemination program is strong, we feel that with some extra resources we could greatly expand this facet of our project.

The success at which we have actually changed the way in which agricultural professionals advise their growers in farm management is still open to question. The SAFS research results must be accessible to effect alternative management practices for impact in using alternative management. In order to bridge the gap of information dissemination from advisors to the growers, it is important to build consensus by facilitating collaborative research and demonstration programs with Extension and NRCS professionals throughout the state. It is our belief that growers have to study the results of locally implemented sustainable practices before adopting any changes in their own farm management.

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Ariena van Bruggen, Department of Plant Pathology
Frank Zalom, Department of Entomology
Tom Kearney, UCCE Farm Advisor, Solano County
Gene Miyao, UCCE Farm Advisor, Yolo County

Farmers:
Jim Durst, Esparto, CA
Bruce Rominger, Winters, CA
Ed Sills, Pleasant Grove, CA

Staff:
Sean Clark, Research Manager
Don Stewart, Crop Production Manager
Julie McNamara, Information Specialist (until 3/97)
Kelly J. Brewer, Information Specialist (from 3/97 until present)

Western Region

Sustainable Agriculture Research and Education

Utah State University
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1500 North 800 East
Logan, Utah 84322-2310

Final Results

Professional Development Program #95-01

Educational Video on Watershed Management Practices for Pinyon-Juniper Ecosystems, entitled "Restoring the Promise"

Location:
Carrizo Demonstration Area in Lincoln National Forest, South central New Mexico

Funding Period:
July 1995 - September 1997

Project Coordinator:
Howard Shanks
RC&D Coordinator
P. O. Box 457
Carrizozo, NM 88301
Phone: (505) 648-4293 or 648-2941
Fax: (505) 648-2558

Grant Award:
$24,000

Objectives

1. To educate land managers, including ranchers, federal and state agency personnel about the various treatment methods and tools utilized to effectively manage pinyon-juniper ecosystems for sustained use.
2. To promote good stewardship of rangeland watersheds by demonstrating proper management techniques and environmental protection measures.
3. To provide a supplemental documentary to the initial video, "Fire and Water: Restoring a Pinyon-Juniper Ecosystem," which detailed the successful approach utilized in the Carrizo Demonstration Area to manage this rangeland ecosystem.

Abstract

The Lincoln National Forest in south central New Mexico has implemented a demonstration project called the Carrizo Demonstration Area, designed to restore and sustain watersheds, increase natural food production for wildlife and livestock and increase biological diversity by managing the area based on ecological principles. The commitment to restore our rangeland watersheds depends on well-educated people who will make the right choices. This project will involve producing and distributing a 15- to 20-minute video that will document effective treatments, tools and "best management practices" utilized in the Carrizo project to manage pinyon-juniper watersheds.

Much of the pinyon-juniper woodland in the southwest does not meet our expectations for a healthy ecosystem. Approximately 3.5 million acres, or about 35 percent of the pinyon-juniper ecosystem on national forests in Arizona and New Mexico, are considered to be in unsatisfactory soil and watershed condition, based on surface erosion rates, gully erosion and soil compaction. Other indicators of ecosystem health that frequently do not meet our description of desired condition in the pinyon-juniper woodlands are declining vegetation and animal diversity, poor species composition and reduced site productivity. Some areas have passed a threshold whereby natural processes such as grass competition and fire can no longer function to maintain successional trends in a desired direction. Dense stands of pinyon-juniper are less drought tolerant and have increased susceptibility to insect attacks.

Restoring pinyon-juniper woodlands to healthy ecological condition is essential for resolving issues of water quality and availability, biological diversity, forest health, riparian conditions and wildlife habitat and livestock grazing capability.

The basis for this video is a publication produced by the USDA Forest Service, Southwestern Region entitled "Watershed Management Practices for Pinyon-Juniper Ecosystems" (August, 1993). This publication outlines various practices, research findings and recommendations for managing pinyon-juniper watersheds. In addition, this video would supplement another recently published video, "Fire and Water: Restoring a Pinyon-Juniper Ecosystem," developed in collaboration with the South Central Mountain Resource Conservation and Development Council, New Mexico State University Agriculture Communications Department and the USDA Forest Service through a grant from the Administrative Council of the Western Region's Sustainable Agriculture Research and Education program. "Fire and Water" details the successful ecological approach to multiple-use management utilized in the Carrizo Demonstration Area, but does not answer the questions of when, where and how to utilize all the various management practices. The Watershed Management Practices video will serve as an invaluable training tool for land managers to properly implement the treatments to restore and sustain their rangeland watersheds.

A video entitled "Restoring the Promise" was produced with the assistance of New Mexico State University Ag Information Department, Las Cruces, New Mexico. A considerable amount of time and effort was

dedicated to this project to insure accurate depiction of watershed conditions before and after treatments and to present reasonable alternatives in achieving watershed restoration. It is a professionally produced video and NMSU is to be commended for their performance. The technical aspects of the video reflect the expertise of Dick Edwards, USDA Forest Service, Ruidoso, NM, in dealing with watershed restoration in pinyon-juniper watersheds. Jan Brydon, a professional script writer, is acknowledged and appreciated for her contributions.

The South Central Mountain RC&D Council will insure coordination with all major participants involved with this project. The video will have a wide distribution and the main target audiences will be ranchers and public land managers. The main vehicle for distributing the videos will be the County Extension Offices, National Forest Ranger Districts, Bureau of Land Management District Offices, Bureau of Indian Affairs Offices and NRCS offices. We anticipate providing 500 copies of the video to be distributed as follows:

New Mexico County Extension Offices

National Forests & Ranger Districts in Arizona and New Mexico

Regional Forester's Offices nationwide

Bureau of Land Management Districts in Arizona and New Mexico

Bureau of Indian Affairs offices in Arizona and New Mexico

NRCS offices including local Soil and Water Conservation Districts

State Extension Services Offices

Public Television Stations

Western Region SARE Program Contacts

Other State and Federal Agencies

Potential Benefits

The impact of this video will be reflected in actual on-ground application of the principles and practices demonstrated in the video. When land managers see first-hand the successful treatments employed in the Carrizo Demonstration Area, it is expected that they will utilize or adopt these methods to fit their particular situation.

Another benefit of this video will be in the increased awareness by students, professors, land users, agencies and the general public of the complex issues involved in watershed restoration and holistic resource management in pinyon-juniper watersheds.

Reactions from Trainees and Ranchers

It is too early to evaluate the impacts of this video on students, trainers, etc.; however, based on feedback from the first video, "Fire and Water," we feel the impacts will be similar and very positive. Specifically, professors at Texas Tech University, Brigham Young University, New Mexico State University and University of Texas are using the video as part of their classroom instruction. The video was also used at conferences, meetings, etc.

There has been considerable positive feedback from local ranchers. Most ranchers are aware of the benefits in watershed restoration and would be willing to implement practices to improve watershed health if it were less expensive.

New Hypothesis and Future Recommendations

Videos such as this one need more exposure. Although it deals specifically with pinyon-juniper issues, it utilizes principles that apply to all ecosystems. The use of public television, satellite downlink, Internet and other media would provide a broader exposure.

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Feedback

Western Region
Sustainable Agriculture Research and Education

We'd like to know what you think about this Annual Report to help us develop better information products for you. Please take a moment to fill out the brief survey.

1. In general, how will you use the Western SARE Annual Report?
   ❒ Read at least some ❒ Skim ❒ Save for future reference ❒ Recycle or discard ❒ Other _____

2. Do you like the loose-leaf format of the report?
   ❒ Like it a lot ❒ Like it some ❒ No opinion ❒ Dislike it. Prefer bound copy.

3. Will you pass on any, some or all of the loose-leaf project "fact sheets" to a friend or colleague?
   ❒ Yes ❒ Probably ❒ No

4. Rate the Annual Report in terms of:

Communicating Western SARE's mission and/or accomplishments	❒ Excellent	❒ Fair	❒ Poor
Communicating information about SARE projects	❒ Excellent	❒ Fair	❒ Poor
Design	❒ Excellent	❒ Fair	❒ Poor
Readability and Clarity	❒ Excellent	❒ Fair	❒ Poor
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Program Report	❒ Excellent	❒ Fair	❒ Poor
Sustainable Agriculture Resources	❒ Excellent	❒ Fair	❒ Poor
Farmer/Rancher Research Grants	❒ Excellent	❒ Fair	❒ Poor
SARE, ACE and Professional Development Progress Reports	❒ Excellent	❒ Fair	❒ Poor
Index to Progress Reports	❒ Excellent	❒ Fair	❒ Poor
State-by-State List of 1997 Awards	❒ Excellent	❒ Fair	❒ Poor
How to Apply for a Grant	❒ Excellent	❒ Fair	❒ Poor

6. Describe your work affiliation
   ❒ Non-profit organization ❒ Government agency ❒ University ❒ Other Agricultural Professional (NRCS, etc.)
   ❒ Farmer or Rancher ❒ Media ❒ Other_____

7. SARE affiliation, if any
   ❒ SARE grant recipient ❒ SARE Administrative Council or Technical Panel Volunteer
   ❒ State Leader for Sustainable Agriculture (PDP)

8. Would you use an Internet version of this report?
   ❒ Yes ❒ No ❒ I would prefer this information on-line or in a searchable format

9. If yes, would you still like a hard copy version?
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Kristen Kelleher
Communications Specialist
Western Region SARE

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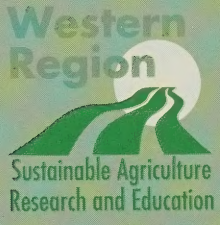

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Cattle photo courtesy USDA Agricultural Research Service.

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